DATA POINT

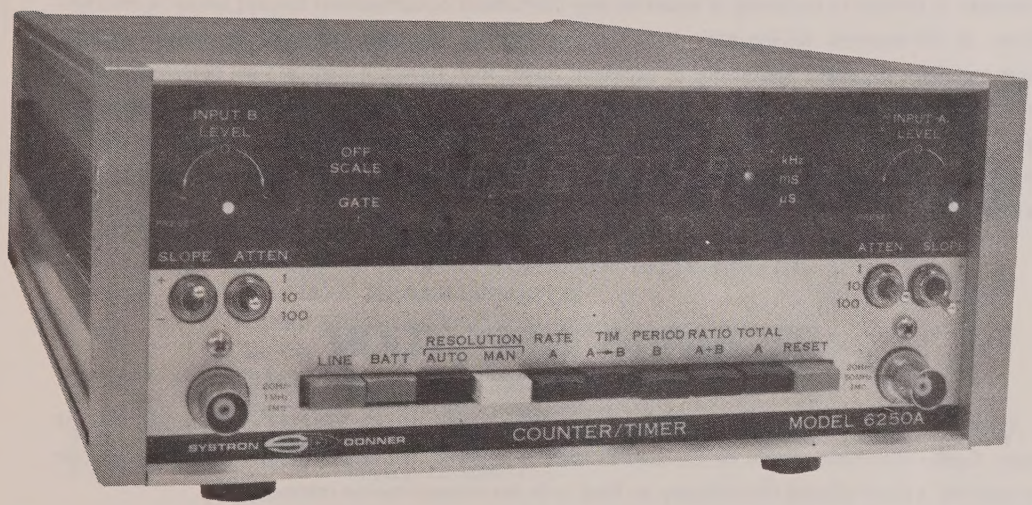
MODEL 6250A
COUNTER TIMER

SERIAL NO.

Peter P. Ⓐ

SYSTRON DONNER

INSTRUCTION MANUAL



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COUNTER TIMER

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This manual contains all ECO's through #9454

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SYSTRON DONNER CORPORATION

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CHAPTER 1
GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains a description, specifications, operating instructions, test and calibration procedures, parts lists, and assembly/schematic drawings for the Systron-Donner Model 6250A Counter/Timer.

The instrument is a 50 MHz universal counter, which features the trim Systron-Donner half-rack design and a highly readable seven-segment display. An eight-digit readout, with leading zero blanking, is standard. All measurements are available, in four-bit parallel, group-serial, binary-coded-decimal (BCD), on a rear panel connector. In addition to line voltage, the counter may be powered by an internal, rechargeable battery or by an external dc voltage source.

The autoranging circuit automatically selects the proper range, to provide the highest display resolution, for the frequency being measured. Maximum autoranging gate time is one second. Manual selection offers the operator a choice of resolutions, enabling selection of the gate time most appropriate for a particular application.

Light weight combined with battery operation make this counter usable anywhere. A full complement of rear panel connectors provide for use as a powerful, versatile, systems-compatible unit.

1.2 SPECIFICATIONS

Table 1.1 is a complete list of standard specifications for the Model 6250A Counter/Timer.

TABLE 1.1 SPECIFICATIONS

FREQUENCY MEASUREMENT	
Range:	20 Hz to 50 MHz
Resolution:	
Automatic	1 Hz to 100 Hz in decade steps
Manual	0.1 Hz to 100 Hz in decade steps
Display:	kHz
Accuracy:	±1 count ± time base accuracy
PERIOD MEASUREMENT	
Range:	
Sine wave input	1 µs to 50,000 µs
Pulse or square wave	1 µs to 999999.99 µs

TABLE 1.1 SPECIFICATIONS (Cont'd)

PERIOD MEASUREMENT (Cont'd)	
Resolution:	
Automatic	.01 µs to .0000001 µs by period average of 10^2 to 10^6 periods. Automatically searches multiple average to fill register.
Manual	Selection of multiple period average from 10^1 to 10^6 periods. Counts 10 MHz.
Display:	µs with autopositioned decimal point.
TIME INTERVAL A→B	
Range:	.0001 ms to 9999999.9 ms
Resolution:	Manual, .0001 ms to .1 ms
Slope selection:	Independent for positive or negative start and stop inputs.
Display:	ms with autopositioned decimal point.
RATIO MEASUREMENT	
Function:	$f_A \div f_B$
Range:	f_A; 20 Hz to 50 MHz f_B; 20 Hz to 1 MHz
Multiplier range:	
Automatic	100 to 10^6; automatically searches multiple average to fill register.
Manual	10 to 10^6
TOTALIZE	
Rate limits:	20 Hz to 50 MHz
Register capacity:	10^8 events
Control:	Front panel switch for totalize/hold
STANDARD TIME BASE	
Aging rate:	$<\pm 3$ parts in 10^7 per month
Temperature stability:	$<\pm 5$ parts in 10^6 from 0° to 50°C (32° to 122°F); ±2 parts in 10^6 from 20° to 40°C (68° to 104°F) typical.

TABLE 1.1 SPECIFICATIONS (Cont'd)

STANDARD TIME BASE (Cont'd)	
Line Voltage:	<±1 part in 10^7 for 10% line variation.
External input:	100 kHz to 10 MHz at 1 V rms into 500 Ω. Must be 10 MHz for proper decimal and legend display.
GENERAL	
Trigger level:	Continuously variable within the range of the step.
Registration:	Eight digits plus off-scale indicator for register overflow and automatic decimal placement.
Display storage:	Holds reading between samples.
Sensitivity:	
Sine wave input	25 mV rms.
Pulse input	100 mV peak-to-peak, with minimum rise time of 1 V/20 ms.
Input impedance:	1 Megohm, 25 pF, ac coupled.
Attenuation:	Step attenuator with factors of X1, X10, and X100.
Maximum input without damage:	X1 attenuation; 500 V peak, dc plus ac components. 250 V rms, 20 Hz to 10 kHz; 50 V rms, 10 kHz to 10 MHz; 10 V rms above 10 MHz.
Dimensions:	8.89 X 21.29 X 34.29 cm (3 1/2" H X 8 3/8" W X 13 1/2" D).
Weight:	4.54 kg (10 lbs) net; 6.81 kg (15 lbs) shipping.
Power:	100, 115, 200, 230 V ac, ±10%, 50-400 Hz, 19 W. Requires .5 ampere fuse for 100, 115 V ac and .25 ampere fuse for 200, 230 V ac operation.

1.3 OPTIONS

Table 1.2 lists all of the standard options available for the instrument.

TABLE 1.2 STANDARD OPTIONS

Option	Description
06	Internal battery pack with an operating cycle of approximately three hours. Contains an automatic, internal recharging circuit.
07	Provides operation from an external dc source.
08	Time base oscillator; improves time base temperature stability to ±1 part in 10^6 from 0 to 50°C.
*11	Time base oscillator; aging rate ±3 parts in 10^9 per day. Temperature stability ±1 part in 10^8 from 0 to 50°C.
*12	Time base oscillator; aging rate ±1 part in 10^9 per day. Temperature stability ±1 part in 10^8 from 0 to 50°C.
*13	Time base oscillator; aging rate ±5 parts in 10^{10} per day. Temperature stability ±1 part in 10^8 from 0 to 50°C.
*32	Rear panel signal inputs.
35	BCD conversion cable; converts group-serial BCD outputs into standard 8-4-2-1 parallel format, including decimal and legend units.
*	Not available with Option 06 or Option 07

CHAPTER 2
INSTALLATION

2.1 INTRODUCTION

The SD Model 6250 Counter/Timer is shipped in an operational condition and is essentially ready for use as received. This chapter outlines the procedures for initial inspection and installation of the instrument. Instructions for reshipment are also included should the unit be returned to Systron-Donner Corporation for service or repair.

2.2 RECEIVING INSPECTION

Prior to accepting the counter from the shipper, inspect the condition of the shipping container for any indication of freight damage. Any sign of such damage must be noted by both the shipper and receiver, and should be reported to the insurance investigator.

Immediately following removal of the instrument from the shipping carton, inspect for possible physical damage incurred during shipment. Check surfaces for scratches or dents and note condition of controls, and connectors. Should any damage be noted, notify your nearest Systron-Donner representative---DO NOT USE THE COUNTER UNTIL INSTRUCTED TO DO SO BY THE REPRESENTATIVE.

2.3 RESHIPMENT

When the instrument is to be repackaged for shipment, use the original packing materials. Your Systron-Donner field office can provide materials similar to those used for the original factory packaging, or repackage the instrument following these general instructions.

General packing instructions:

1) Attach a tag to the unit indicating the model number, serial number, name and address of the instrument owner, and a summary of the service or repairs required.
2) Wrap the instrument in heavy paper or plastic prior to placing it into the shipping container.
3) Select a strong carton or wooden box to house the instrument.
4) Use an adequate layer of shock-absorbing material on all sides of the instrument. Protect the front panel with additional layers of cardboard. Be certain that there is no movement of the unit within the container.
5) Seal the package with strong tape or metal bands.
6) Mark the shipping container "FRAGILE-DELICATE INSTRUMENT" to ensure careful handling.

7) Be certain that all correspondence refers to full instrument nomenclature (model and serial number).

2.4 POWER REQUIREMENTS

The Model 6250A Counter/Timer is supplied with a standard three-conductor power cord, which, when plugged into an appropriate power receptacle, grounds the chassis to protect operating personnel from certain electrical hazards. When the power cord is mated to a two-conductor outlet, a cord adapter plug (properly installed) will provide the same protection.

The instrument operates from either 100, 115, 200, or 230 V at 50 to 400 Hz and consumes approximately 19 W of power. Taps on the primary of the power transformer are provided to accommodate these power line requirements. Use a 0.5 A fuse for 100, 115 V ac and a 0.25 A fuse for 200, 230 V ac.

Test Assembly drawing #053629 shows the proper placement of transformer taps for the line voltage selection. Prior to connecting the power cord to a line source, ensure that the transformer jumpers are properly connected for the available line voltage. See Chapter 4, Section 4. for cover removal.

2.5 CIRCUIT CHECK

A complete operational checkout of all modes is contained in Chapter 4, Section 4.4.

CHAPTER 3
OPERATION

3.1 INTRODUCTION

Front and rear panel controls, connectors, and indicators are described in this chapter. Figures 3.1 and 3.2 illustrate the front and rear panels while Tables 3.1 and 3.2 present a description of each function. Information covering factors which effect measurement accuracy, and a step-by-step operating procedure for each of the operating modes is included.

3.2 FRONT PANEL FUNCTIONS

Table 3.1 describes the controls, connectors, and indicators on the front panel of the instrument. Refer to Figure 3.1 for the index number location.

TABLE 3.1 FRONT PANEL FUNCTIONS

Index	Name	Description
1	LINE	This push-on, push-off switch applied ac power to the instrument. When option 06 is installed, the internal batteries are charged when the instrument power cord is connected to the line voltage.
2	BATT	This push-on, push-off switch applies battery power when either option 06 or option 07 is installed.
3	RESOLUTION	
	AUTO	When depressed, this interlocked pushbutton switch places the counter in autoranging. Interlocked with MAN switch.
	MAN	Sequentially depressing this interlocked pushbutton switch manually sequences the resolution from 0.1 Hz to 100 Hz in decade steps. Interlocked with AUTO switch.
4	RATE A	This interlocked pushbutton switch selects the frequency mode of operation for INPUT A only. RATE A, TIM A→B, PERIOD B, RATIO A÷B, and TOTAL switches are interlocked.

TABLE 3.1 FRONT PANEL FUNCTIONS (Cont'd)

Index	Name	Description
5	TIM A→B	This interlocked pushbutton switch selects measurement of the time interval between INPUT A and INPUT B. The start and stop may be triggered on either of the + or - slope switch selections.
6	PERIOD B	This interlocked pushbutton switch selects period measurement of INPUT B.
7	RATIO A÷B	This interlocked pushbutton switch selects ratio measurement of signals on INPUT A and INPUT B.
8	TOTAL A	This interlocked momentary pushbutton switch selects totalizing of events through INPUT A. Depressing the switch opens the gate to begin totalizing and depressing the switch the second time closes the gate.
9	RESET	When depressed, this momentary pushbutton switch resets the instrument.
	INPUT A	
10	20 Hz - 50 MHz 1 MΩ	This BNC connector accepts the "A" input to be measured.
11	SLOPE	Single-pole-double-throw toggle switch; selects the triggering slope of the start input when the TIM A→B switch is depressed.
12	ATTEN	Double-pole-double-throw toggle switch; selects attenuation of either X1, X10, or X100.
13	LEVEL	Rotary knob controlling a trigger level potentiometer. PRESET position centers the voltage to approximate zero crossover.
	INPUT B	
14	20 Hz - 1 MHz 1 MΩ	This BNC connector accepts the "B" input to be measured.
15	SLOPE	Single-pole-double-throw switch; selects the triggering slope of the stop input when the TIM A→B switch is depressed.
16	ATTEN	Double-pole-double-throw toggle switch; selects attenuation, X1, X10 or X100, for the B INPUT.

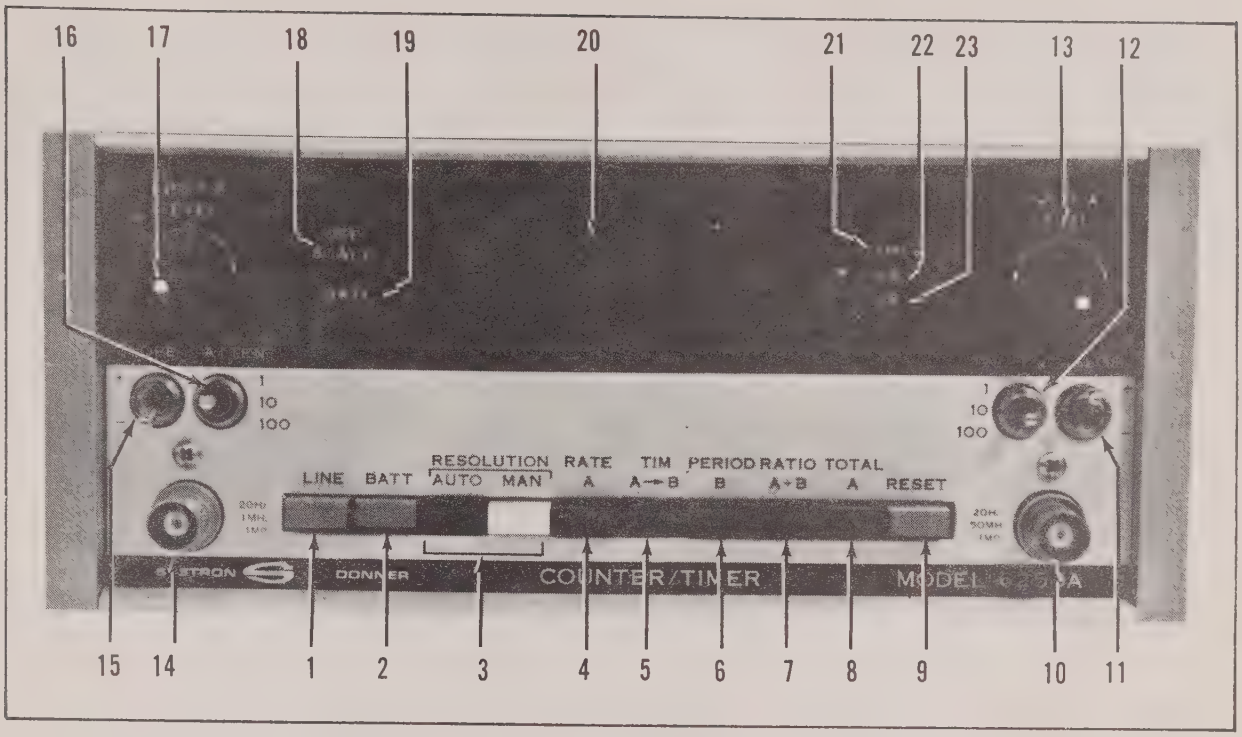


FIGURE 3.1 FRONT PANEL

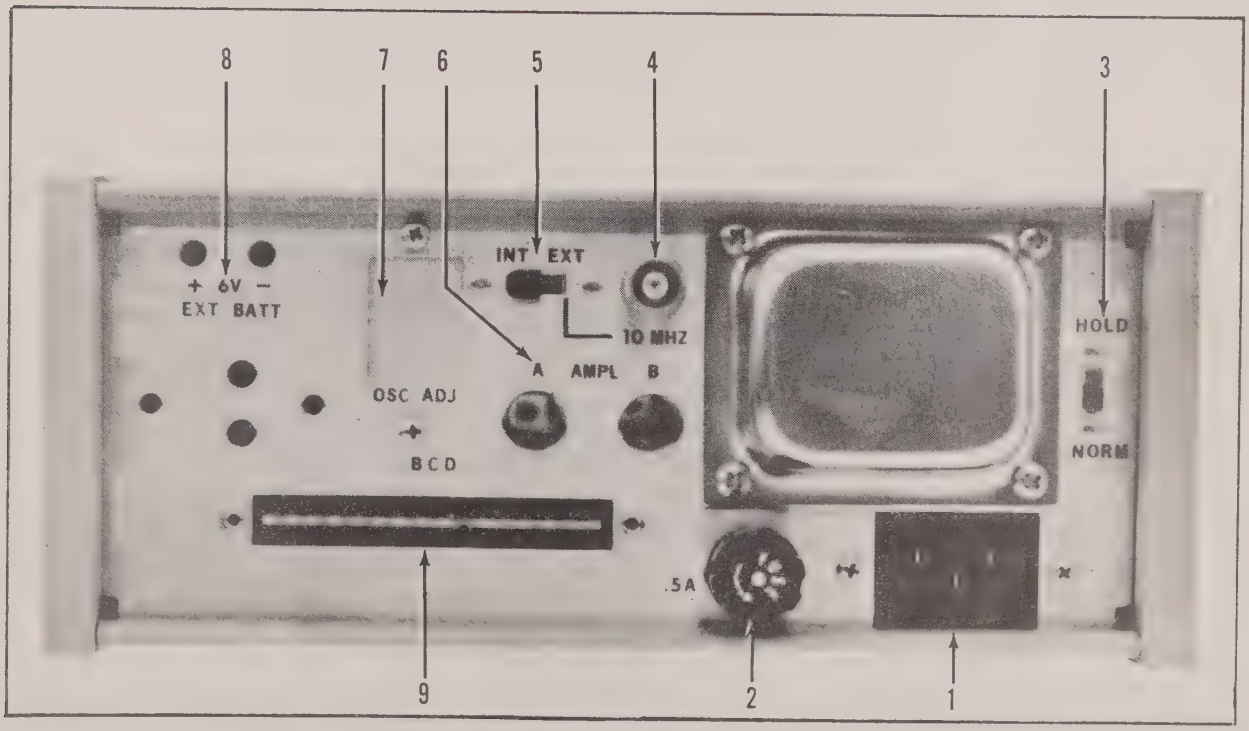


FIGURE 3.2 REAR PANEL

TABLE 3.1 FRONT PANEL FUNCTIONS (Cont'd)

Index	Name	Description
17	LEVEL	Rotary knob controlling a trigger level potentiometer. PRESET position centers the voltage to approximately zero cross-over.
18	OFF-SCALE	LED indicator; lights when the readout exceeds 99999999.
19	GATE	LED indicator; lights when gate is open.
20	Readout/Digits	Seven-segment, eight-digit readout; displays the measurement data with decimal point.
21	KHz	LED indicator; shows the units (kHz) and mode (RATE) when lit. Does not light when TOTAL switch is depressed.
22	mS	LED indicator; shows the units (ms) and mode (TIM A→B) when lit.
23	µs	LED indicator; shows the units (µs) and mode (PERIOD B) when lit.

3.3 REAR PANEL FUNCTIONS

The following table describes the controls and connectors on the rear panel of the instrument. Refer to Figure 3.2 for the index number location.

TABLE 3.2 REAR PANEL FUNCTIONS

Index	Name	Description
1	Power Plug Socket	Connects the ac line card to the instrument.
2	Fuse Holder	Contains power circuit fuse.
3	HOLD/NORM	Slide switch; in HOLD, allows a single measurement cycle and holds display. In NORM, allows continuous measurement and display.
4	10 MHz	BNC connector; accepts an external time base input of 100 kHz to 10 MHz. Must be 10 MHz for proper decimal and legend display.
5	INT/EXT	Slide switch; selects either the internal time base or an external time base source.

TABLE 3.2 REAR PANEL FUNCTIONS (Cont'd)

Index	Name	Description
6	A AMPL B	Option 32; BNC connectors accept rear panel input of both "A" and "B" measurement data.
7	OSC ADJ	Oscillator adjustment available on rear panel when an optional high-stability oscillator is installed.
8	6 V EXT BATT	Connectors for an external battery when option 07 is installed.
9	BCD	Card edge connector; provides serial, four-bit parallel BCD information.

3.4 ACCURACY OF MEASUREMENT

There are certain factors inherent in any digital counter which may cause measurement errors. Close attention to control settings and proper operation will reduce these errors to a minimum.

3.4.1 Oscillator Stability

The gating precision, and, therefore, the accuracy of the count, is dependent upon the stability of the internal oscillator.

In the standard instrument, the oscillator is initially set to within ±1 part in 10^7 of a 1 MHz frequency standard having at least an order of magnitude higher stability.

Deviation of the oscillator from this frequency then becomes a function of several factors; the most significant being time. Due to certain processes in the frequency determining elements of the oscillator, an "aging" rate is established that can be measured and specified for the oscillator. This aging rate is specified to be less than ±3 parts in 10^7 per month. Generally, this aging rate decreases with time (providing the instrument remains continuously energized). The error due to oscillator instability may be estimated from:

$$\text{Max \% error} = (\pm 3/10^7 \times M) \times 100$$

where; M is the number of months since last calibrated.

Oscillator stability is also a function of line voltage and temperature. To achieve the highest accuracy of measurement, the following considerations apply:

1) Maintain the instrument plugged-in and continuously energized.
2) Maintain constant environmental conditions.
3) Monitor or regulate line voltage.
4) Calibrate instrument at intervals consistent with maximum allowable error.

3.4.2 Gating Error

All types of digital measuring instruments are subject to an irreducible ±1 count ambiguity in the least significant digit of the display. This error is possible because the signal counted is not coherent (synchronized) with the time base pulses that control the signal gate. As illustrated in Figure 3.3, the first or last cycle of the input signal may, or may not, pass through the signal gate during the selected measurement interval.

As the measured frequency is increased, the percent of error due to the ±1 count ambiguity is reduced, since it becomes less significant compared to the total count. In any case, the maximum percentage of error is a function of the frequency measured and the number of pulses counted; i.e., the time base selected, and may be expressed by:

$$\text{Max \% error } (\leq 100\%) = \pm\frac{1}{fxT} \text{ X } 100$$

where: f is the frequency measured in Hz and T is the selected time base in seconds. Thus, to measure 1 MHz with a maximum gating of ±0.001%, a 10 Hz resolution must be utilized.

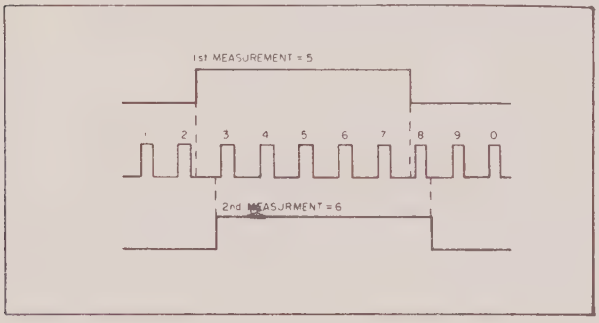


FIGURE 3.3 GATING AMBIGUITY

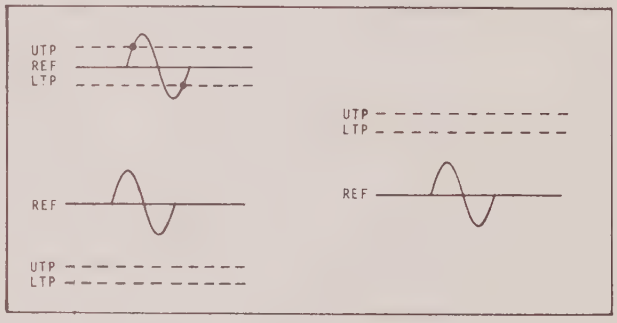


FIGURE 3.4 TRIGGERING LEVELS

3.4.3 Trigger Level Control Adjustment

Unstable and inaccurate measurements often result from inconsistent triggering of the signal processing circuits. In many cases, this is due to improper adjustment of the LEVEL control for the type of signal being measured. Figure 3.4 illustrates the nominal input triggering level and the effect of the LEVEL control. Note that there is nominal separation (or hysteresis) between the upper and lower trigger levels; and, in operation, the input signal must cross both levels to complete a triggering cycle. The LEVEL control acts to offset the reference level of the input signal.

Generally, the setting of the LEVEL control for sinusoidal inputs should be made at approximately the center of the steepest slope on the input waveform to ensure reliable counting. However, careful attention must be paid to the amplitude/shape of the input signal when nonsinusoidal, unknown, or marginal signals are being measured. It is recommended that an oscilloscope be utilized for signal analysis under these conditions. Figures 3.4 through 3.7 illustrate a variety

of situations leading to inaccurate counting and some possible solutions.

1) PROBLEM:

Spurious counts from superimposed noise transients of sufficient amplitude to cross trigger levels, (Figure 3.5).

POSSIBLE SOLUTIONS:

a. Adjust LEVEL control for triggering on steepest portion of signal slope.

b. Provide attenuation (either internal or external) to reduce noise peaks below trigger hysteresis.

c. Connect low-pass filter between signal source and instrument input.

2) PROBLEM:

Missing count due to amlitude modulation of input signal, (Figure 3.6).

POSSIBLE SOLUTION:

a. Adjust LEVEL control for triggering on steepest portion of slope. Modulated signal must be of sufficient amplitude to cross through both trigger levels.

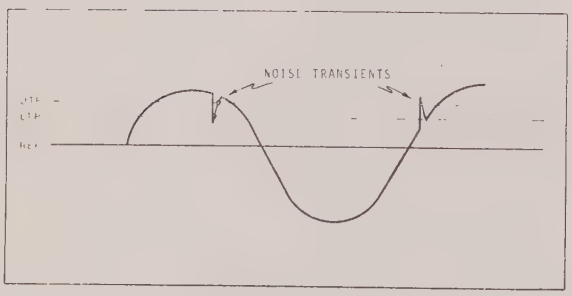


FIGURE 3.5 SPURIOUS COUNTS DUE TO NOISE TRANSIENTS

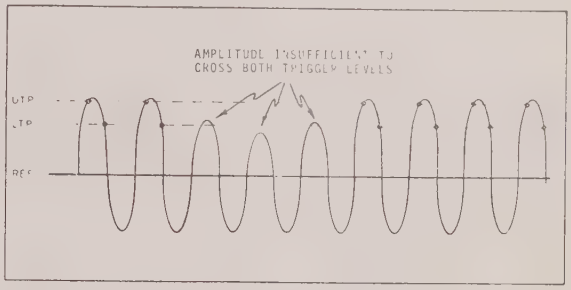


FIGURE 3.6 MISSING COUNTS DUE TO AMPLITUDE MODULATION

3) PROBLEM:

Monopolar pulses intersect only one triggering level (Figure 3.7).

POSSIBLE SOLUTIONS:

a. Offset LEVEL control so that pulses intersect both levels. Pulse amplitude must be greater than hysteresis value.

b. Externally differentiate the pulses.

4) PROBLEM:

Ringing on leading and trailing edges of signal pulse. Usually a result of mismatch between instrument input and signal source when source impedance is 50 or 75 Ω, (Figure 3.8).

POSSIBLE SOLUTION:

a. Properly terminate input signal signal cable at INPUT connector on front panel of instrument (usually a 50 or 75 Ω termination in shunt with INPUT).

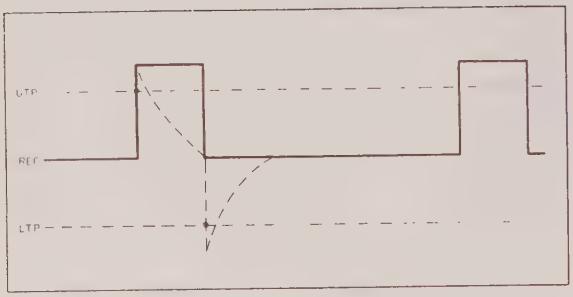


FIGURE 3.7 MONOPOLAR PULSES INTERSECTING ONLY ONE TRIGGER LEVEL

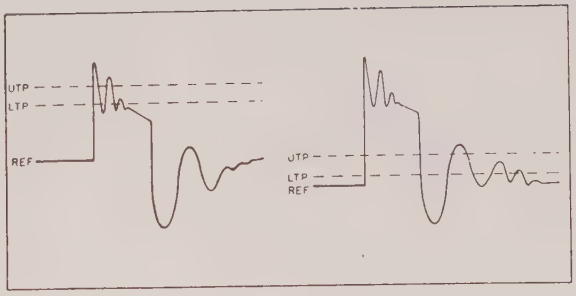


FIGURE 3.8 RINGING ON PULSE WAVEFORM CAUSES COUNT ERROR

3.4.4 Period Measurements

For high frequency measurements, the ±1 count gating error is small compared to the total count. At low frequencies, however, the error may become important. This was discussed in Section 3.4.2 and is shown graphically by the sloping curves in Figure 3.10 for different gate times. Increasing the time base by a factor of ten increases the accuracy by the same factor, up to the limit of the oscillator accuracy itself. But, even with a 10-second time base, when measuring a 100 Hz signal, the accuracy is limited to ±1 part in 10^3 or 0.1%. For this reason the PERIOD mode of measurement is used for greater accuracy at low frequencies.

In PERIOD mode, the unit measures the time of one complete cycle of the input frequency. In multiple period it measures the time of 10^n cycles, where n is selectable from 1 to 6, and displays the average time of one period. For greatest accuracy the triggering of the timing interval should occur on the steepest portion of the input wave. For pure sine waves and many other signals this is the midpoint or zero axis crossing.

Period and related time-interval measurements are subject to a trigger-time error caused by noise on the input signal (Figure 3.9). The total signal may be considered as an ideal noise-free signal with a superimposed noise component. The noise, added to the ideal signal, may trigger the channel before or after the selected instant for triggering. The maximum error in time, including start and stop for a given peak-to-peak noise voltage on the slope of an ideal signal at the trigger level, is:

$$t \text{ (seconds)} = \frac{Vn}{S}$$ where: Vn = peak-to-peak noise (volts)
S = slope of ideal signal (volts/second)

Related to the period itself the error is $\frac{t}{T}$ where: T is the actual period of the signal in seconds.

For the sine wave triggering at the zero axis crossing, the maximum triggering error may be derived from the foregoing equations as:

$$\pm \frac{Vn}{N \pi Vs}$$

where: N = number of periods measured

At higher signal frequencies the effect of the ±1 count time base gating ambiguity is additive to the triggering error as:

$$\pm \frac{f_s}{Nf_{TB}}$$

where: f_s = signal frequency (Hertz)

f_{TB} = time base frequency (10 MHz in this instrument)

Thus, the total maximum error in a period measurement

$$\pm \frac{Vn}{N \pi Vs} + \frac{f_s}{Nf_{TB}}$$

The horizontal curves in Figure 3.10 are plotted to show this error for N from 1 to 10^5 and assume a typical signal-to-noise ratio of 40 dB (100:1) and a time base frequency of 10 MHz. By using both sets of curves, the figure shows which type of measurement (frequency or period) will yield the lowest gating error.

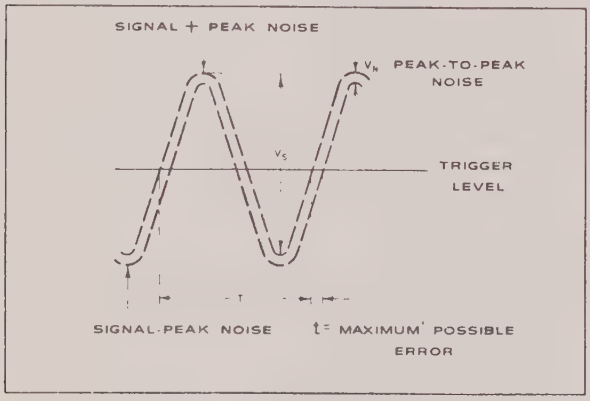


FIGURE 3.9 PERIOD AND TIM TRIGGERING ERROR CAUSED BY SIGNAL NOISE

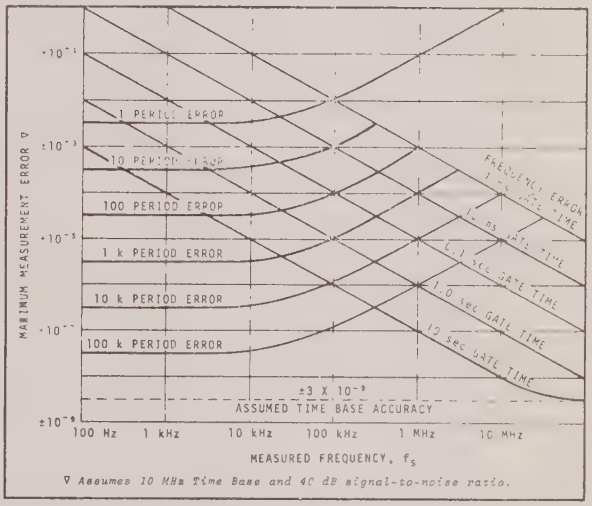


FIGURE 3.10 MEASUREMENT ERROR vs FREQUENCY

3.5 OPERATING PROCEDURES

The Model 6250A has five operating modes; RATE A, TIM A→B, PERIOD B, RATIO A÷B, and TOTAL A. RATE A measures frequencies from 20 Hz to 50 MHz. TIM A→B measures the time interval between inputs to the A and B input connectors. PERIOD B measures the period of the B input frequency. RATIO A÷B measures the ratio of the A and B inputs. TOTAL A is a direct count of events applied to the A input. Either automatic resolution or manual resolution selection may be used for all operational modes except TIM A→B. Manual resolution must be used in this mode. *Ensure that the transformer jumpers are correct for the input line voltage before operating the instrument.* See Test Assembly drawing #053629.

3.5.1 Rate A Measurements

To measure a sine wave or pulsed frequencies from 20 Hz to 50 MHz, use the following procedure.

1) Depress LINE switch; or, BATT switch if using internal or external dc source, options 06 or 07.

2) Depress the AUTO switch if automatic resolution is desired. For manual resolution successively depress the MAN switch to obtain the desired resolution.

3) Position the ATTEN switch to X1, X10, or X100, adjust as required.

4) Set the LEVEL switch to PRESET.

5) On the rear panel, position the HOLD/NORM switch to NORM, reposition to HOLD to inhibit instrument recycling. Position the INT/EXT switch to INT for the internal time base or to EXT if using an external standard.

6) Connect an input signal, 20 Hz to 50 MHz, to the 20 Hz - 50 MHz connector; momentarily depress RESET switch.

7) Read the frequency on the display.

3.5.2 Time Interval Measurements

When making a time interval measurement use the following procedure.

1) Depress the LINE switch; or, BATT switch if using internal or external dc source, options 06 or 07.

2) Depress the TIM A→B switch and the MAN switch. Depress RESET after each time MAN switch is depressed.

3) Position the "A" ATTEN switch to X1, X10, or X100; the "A" SLOPE switch as desired and adjust the "A" LEVEL switch as required.

4) Position the "B" ATTEN switch to X1, X10, or X100; the "B" SLOPE switch as desired and adjust the "B" LEVEL switch as required.

5) On the rear panel position the HOLD/NORM switch to NORM; or to HOLD to inhibit instrument recycling. Position the INT/EXT switch to INT for the internal time base or to EXT for use with an external standard.

6) Connect a signal, 20 Hz to 50 MHz, to the "A" input connector. Connect a signal, 20 Hz to 1 MHz, to the "B" input connector.

7) Read the proper indication on the display.

3.5.3 Period B Measurements

To measure the period of "B" input signals, use the following procedure.

1) Depress the LINE switch; or, BATT switch if using internal or external dc source, options 06 or 07.

2) Depress the PERIOD B switch. Depress the AUTO switch for automatically selected resolution or successively depress the MAN switch for desired resolution.

NOTE

To recycle the instrument in the PERIOD B mode with no signal applied while manually selecting desired resolution, depress the RESET switch after each RESOLUTION selection.

3) Position "B" ATTEN switch to either X1, X10, or X100. Set "B" LEVEL switches as required.

4) On the rear panel, position the HOLD/NORM switch to NORM: or to HOLD to inhibit instrument recycling. Position the INT/EXT switch to INT for internal time base, or to EXT for use with an external standard.

5) Connect an input signal, 20 Hz to 1 MHz, to the "B" input connector.

6) Read the proper indication on the display.

3.5.4 Ratio A÷B Measurements

When measuring the ratio of "A" input divided by "B" input, use the following procedure.

1) Depress the LINE switch; or, BATT switch is using internal or external dc source, options 06 or 07.

2) Depress the AUTO switch for automatically selected resolution, or successively depress the MAN switch for manually selected resolution.

3) Depress the RATIO A÷B switch.

4) Position "A" ATTEN switch and "B" ATTEN switche to X1, X10, or X100.

5) Set "A" level control and "B" level control as required.

6) Connect a signal 20 Hz to 50 MHz to the "A" input connector and a signal 20 Hz to 1 MHz to the "B" input connector.

7) Read the proper indication on the display.

3.5.5 Total Measurements

This mode of operation allows the events to be totalized or accumulated. The gate is manually opened or closed by sequential operation of the TOTAL A momentary pushbutton switch. To make a measurement in this mode of operation, use the following procedure.

1) Depress the LINE switch; or, BATT switch if using an internal or external dc source, options 06 or 07.

2) Position the "A" ATTEN switch to either X1, X10, or X100.

3) Position the "A" LEVEL control to PRESET or as required.

4) On the rear panel, position the HOLD/NORM switch to NORM: or to HOLD to inhibit instrument recycling. Position the INT/EXT switch to INT for internal time base, or to EXT for use with an EXT standard.

5) Connect a signal, 20 Hz to 50 MHz, to the "A" input connector.

6) Depress the TOTAL A switch to begin totalizing; when ready to stop totalizing, again depress the TOTAL A switch.

7) Read the proper indication on the display.

CHAPTER 4
MAINTENANCE AND CALIBRATION

4.1 INTRODUCTION

This chapter contains procedures for maintenance and calibration of the Model 6250A to aid the user in maintaining the instrument in proper operating condition. Whenever a Systron-Donner instrument requires service, the nearest SD representative should be contacted. He can provide field service, or arrange factory returns, when necessary. Address all inquiries on operation or application to your nearest sales representative; or, Sales Manager:

SYSTRON-DONNER CORPORATION
CONCORD INSTRUMENT DIVISION
10 Systron Drive
Concord, California 94518
Phone: (415) 676-5000
TWX: 910-481-9479
Cable: SYSTRONDONNER

Specify both model and complete serial number in all correspondence.

4.2 TEST EQUIPMENT

Test equipment recommended for maintaining and checking performance is listed in Table 4.1. Equivalent test equipment having similar characteristics may be substituted when necessary.

TABLE 4.1 RECOMMENDED TEST EQUIPMENT

Type	Characteristics	Recommended Model
Oscilloscope	80 MHz bandwidth, plug-in type	Tektronix Model 581
Vertical plug-in	10 mV/cm sensitivity	Tektronix Model 82
Signal Generator	10 Hz to 10 MHz	HP Model 651B
Signal Generator	10 MHz to 480 MHz	HP Model 608C
Digital Voltmeter	0.1% dc - 1% ac, of full scale	SD Model 7005A
Pulse Generator	1 Hz to 50 MHz	SD Data Pulse Model 116
Frequency Standard	1 MHz, stability 10^{10} short term	General Technology Model 304B
Autotransformer	Variable from 103 to 127 V ac	Superior Model UCIM

4.3 ASSEMBLY AND CONNECTOR LOCATION

Location of assemblies and chassis mounted parts is shown in drawings 053629, and 053628. Drawing 7-053630 shows the wiring interconnections between the assemblies.

4.4 OPERATIONAL TEST

These tests may be used to determine the calibration/repair requirements or to check the instrument after calibration/repair has been accomplished. Operation and performance of all circuits in the instrument can be verified by the following tests. Prior to connecting the line cord to the line source, ensure that the transformer jumpers are properly connected for the line voltage available.

4.4.1 Rate Test

1) Set the counter controls:

LINE	Depress
AUTO	Depress
RATE A	Depress
"A" ATTEN	1
"A" SLOPE	As desired
"A" LEVEL	PRESET
INT/EXT (rear panel)	INT
HOLD/NORM (rear panel)	NORM

2) Connect the 10 MHz to 480 MHz generator to the "A" input connector. Adjust the generator for an output of 50 MHz at 25 mV rms. Observe an indication of 50000.000 kHz. All readings are ± dial accuracy.

3) Vary the frequency of the signal generator in a random manner from 50 MHz to 10 MHz. Maintain the signal level at 25 mV rms. Observe the proper indication on the display.

4) Adjust the signal generator for an output of 20 MHz at a signal level of 25 mV rms. Depress the MAN switch.

5) Cycle the counter through all resolution positions by repetitively depressing the MAN switch. Observe the proper indication on the display.

Time Base	Display
.01 s	20000.0 kHz
.1 s	20000.00 kHz
1 s	20000.000 kHz
10 s	(2)0000.0000 kHz

6) Depress TOTAL A switch. Observe the gate light is on and the instrument is counting. Allow the instrument to continue counting until the register is filled. Observe the off-scale light come on as the most significant digit goes from 9 to 0.

7) Depress the TOTAL A switch and observe the instrument stops counting.

8) Depress the RESET switch and observe that the instrument resets to zero.

9) Depress RATE A switch. Position the HOLD/NORM switch, on rear panel, to HOLD. Observe instrument does not recycle. Position HOLD/NORM switch to NORM. Observe the instrument resumes recycling.

10) Connect the 10 Hz to 10 MHz signal generator and repeat 1) through 3) using signals from 20 Hz to 10 MHz.

4.4.2 Time Interval Test

1) Set the counter controls:

LINE	Depress
MAN	Depress
TIM A→B	Depress
"A" ATTEN	1
"A" SLOPE	+
"A" LEVEL	Adjust as required
"B" ATTEN	1
"B" SLOPE	+
"B" LEVEL	Adjust as required
INT/EXT (rear panel)	INT
HOLD/NORM (rear panel)	NORM

2) Connect the pulse generator to the "A" input and "B" input connectors. Adjust for a positive pulse with a width of 2 µs, an amplitude of 100 mV peak-to-peak, and a repetition rate of 1 kHz.

3) Observe an indication of 1.0000 ms on the display.

4) Position the "A" SLOPE switch to - and the "B" SLOPE switch to +. Observe an indication of .9980 ms on the display.

5) Position the "A" SLOPE switch to + and the "B" SLOPE switch to -. Observe an indication of 1.0020 ms on the display.

6) Adjust the pulse generator for a negative pulse of 2 µs, an amplitude of 100 mV peak-to-peak, and a repetition rate of 1 kHz. Adjust LEVEL controls as required. Observe an indication of 1.0000 ms on the display.

7) Depress the MAN switch repetitively to cycle the instrument through the RESOLUTION positions. Depress the RESET switch

after each time the MAN switch is depressed. Observe the proper indication on the display.

Time Base	Display
.01 MHz	1.0 ms
.1 MHz	1.00 ms
1 MHz	1.000 ms
10 MHz	1.0000 ms

4.4.3 Period Test

1) Set the counter controls:

LINE	Depress
AUTO	Depress
PERIOD B	Depress
"B" ATTEN	1
"B" SLOPE	As desired
"B" LEVEL	PRESET
INT/EXT (rear panel)	INT
HOLD/NORM (rear panel)	NORM

2) Connect the 10 Hz to 10 MHz signal generator to the "B" input connector. Adjust the signal generator for an output frequency of 1 MHz, with an amplitude of 25 mV rms.

3) Observe an indication of 1.0000000 µs, ± generator dial accuracy.

4) Depress the MAN switch and cycle the instrument through all of the period multipliers, 10^1, 10^2, 10^3, 10^4, 10^5, and 10^6. The period multiplier changes each time the MAN switch is depressed. Observe the proper indication on the display.

Multiplier	Display
10^1	1.00 µs
10^2	1.000 µs
10^3	1.0000 µs
10^4	1.00000 µs
10^5	1.000000 µs
10^6	1.0000000 µs

5) Depress the MAN switch to obtain the 10^1 position. Vary the frequency input at frequencies from 20 Hz to 1 MHz. Observe the proper indication on the display.

4.4.4 Ratio Test

1) Set the counter controls:

LINE	Depress
AUTO	Depress
RATIO A÷B	Depress
"A" ATTEN	1
"A" SLOPE	+
"A" LEVEL	As required
"B" ATTEN	1
"B" SLOPE	+
"B" LEVEL	As required
INT/EXT (rear panel)	INT
HOLD/NORM (rear panel)	NORM

2) Connect the 10 Hz to 10 MHz signal generator to the "B" input connector. Adjust for a frequency of 1 MHz with an amplitude of 25 mV rms.

3) Connect the 10 MHz to 480 MHz signal generator to the "A" input connector. Adjust for a frequency of 50 MHz with an amplitude of 25 mV rms.

4) Observe a proper indication of 50.000000, ± generator dial accuracy.

5) Repetitively depress the MAN switch to cycle the instrument through all the multiples; 10^1, 10^2, 10^3, 10^4, 10^5, and 10^6. All readings are ± generator dial accuracy.

Multiple	Display
10^1	50.0
10^2	50.00
10^3	50.000
10^4	50.0000
10^5	50.00000
10^6	50.000000

4.5 ROUTINE MAINTENANCE

A regular program for maintenance and inspection every five to six months is recommended for this unit. As part of these regualr procedures, the instrument should be checked in the following manner:

1) Disconnect ac power and remove the top and bottom covers.

2) Make a thorough visual inspection of all wiring and cables. Check for frayed, loose, or burned wires.

3) Check the physical integrity of all components. Look for burned or cracked components, loose solder connections, leak-

age of insulation compounds, and general physical damage. When a printed-circuit board contains integrated circuit packages, ensure that all packages are firmly mounted. Never unnecessarily remove and replace a package.

4) Check all front panel switches and controls for loose or broken terminals, loose or sticking shafts, etc.

5) If the internal panel surfaces and components have an excessive amount of dust deposited on them, use a soft brush and low-pressure stream of air to remove the foreign material.

CAUTION

Do not clean P.C. boards or small internal components with a stiff brush or solvents, since damage to the circuits may result. A high-powered vacuum cleaner device should not be used on small internal components.

6) Wipe the external surfaces of the instrument with a soft damp cloth to remove dirt, fingerprints, and other foreign materials.

7) Replace the top and bottom covers and reconnect ac power. Check instrument performance in accordance with procedures given in Section 4.3. If performance does not match or exceed the specifications listed in Chapter 1 of this manual, corrective maintenance may be required.

4.6 PRINTED-CIRCUIT BOARD REPAIR

When replacing integrated circuits or other electronic components soldered to printed-circuit boards, the procedures indicated below must be followed or damage to the board may result:

1) Determine by troubleshooting techniques, which integrated circuit or discrete component(s) has failed.

2) Remove the defective component(s) from the board by cutting the pins or leads with a small diagonal clipping tool. (Always remove and replace the entire component).

3) Apply heat (40-50 W soldering iron) sparingly to each of the cup pins or leads and remove from the board; clean the hole(s) with a toothpick or solder suction tool.

CAUTION

Always trim semiconductor leads only after soldered installation is complete. This procedure greatly lessens the possibility of component failure due to shock-wave damage caused by the trimming tool.

4) Form the tinned leads of the replacement part and insert in the printed-circuit holes; solder, then trim leads to extend 1/16-inch beyond the back surface of the board. (Use only 63-37 solder with maximum 1/16-inch diameter).

5) When soldering semiconductor devices and all small components, be sure to use a heat sink tool or long-nosed plier connected to the component lead(s) while each is being soldered. Allow The soldered connection to cool before removing the heat sink.

6) Clean all dirt and solder-flux from the printed circuit traces by liberal application of isopropyl alchohol or freon-type solvents.

4.7 CALIBRATION

In order to ensure instrument operation at or above the specifications listed in Table 1.1, adjustment of the 10 MHz oscillator and the A and B amplifiers must be performed on a regular basis.

4.7.1 A Amplifier Adjustment, A3

1) Set controls:

A ATTEN	1
INPUT A LEVEL	PRESET
AUTO	Depress
RATE A	Depress

2) With the digital voltmeter, monitor A3TP1.

3) Adjust R6 for a reading of +2 Vdc ±100 mV.

4) Connect the 10 MHz to 480 MHz signal generator to the 20 Hz to 50 MHz BNC connector. Adjust the signal generator to a frequency of 50 MHz at 100 mV rms. Observe 50000 kHz on the display.

5) Decrease input signal amplitude and adjust R22 until the best sensitivity is obtained. This should be a signal amplitude below 25 mV rms.

4.7.2 B Amplifier Adjustment, A4

1) Set controls:

B ATTEN	1
PERIOD B	Depress
INPUT B LEVEL	PRESET
RESOLUTION MAN	Minimum

2) With the digital voltmeter, monitor A4TP1.

3) Adjust R6 for a reading of +2 Vdc ±100 mV.

4) Connect the 10 Hz to 10 MHz signal generator to the 20 Hz to 10 MHz BNC connector. Adjust the generator for a 1 MHz signal at a level of 100 mV rms. Observe an indication of 1.0 μs.

5) Decrease the signal level and adjust R22 until the best sensitivity is achieved. This should be a signal level below 25 mV rms.

4.7.3 Oscillator Adjustment, A5

1) Set controls:

AUTO	Depress
PERIOD B	Depress

2) Connect the 1 MHz frequency standard to the 20 Hz to 1 MHz BNC connector.

3) Adjust C2 for a reading of 1.0000000 µs ±1 count.

4) As an alternate method of adjusting the oscillator, connect the 1 MHz frequency standard to the external sync of the oscilloscope.

5) Connect the vertical input of the oscilloscope to the collector of Q3 on the oscillator assembly. Adjust C2 for a drift of 1 cycle per second or less on the oscilloscope display.

CHAPTER 5
PRINCIPLES OF OPERATION

5.1 INTRODUCTION

The Model 6520A is an integrated circuit, multi-function counter that measures the frequency or period of a signal; the time interval between two points on a signal, or on two related or unrelated signals; the ratio of two frequencies; or the total number of signal pulses. Measurements are classified under the two basic functions of Frequency and Period. Other operating modes are modifications of these two functions. The measuring techniques compare the frequency or period of an unknown signal to a time base derived from a reference frequency.

Figure 5.1 is a functional block diagram of the instrument. The system consists of front panel controls, input amplifier-shapers, function select logic, functions control logic, time base, oscillator reference, decade counters, readout unit, and power supply. The function switches on the front panel connect the appropriate circuit for the particular measuring functions through the function select logic. The resolution switches select a time base reference signal. The combined condition of the two switches determine the proper decimal point placement and measurement unit indication in the readout.

When an unknown signal is connected to the instrument, the input amplifier-shaper converts the signal into a rectangular waveform. In Frequency mode, the rectangular waveform is converted into counting pulses that are directed to the decade counters when the count gate is opened by the selected time base. In Period mode, the rectangular waveform opens the count gate for multiples of ten periods of the unknown signal. During this period the decade counters count the number of pulses from the time base.

In either mode, the serial data is converted into BCD format by the decade counters. Then the BCD data is decoded into decimal outputs by the decoder driver. The decoder driver drives seven-segment readout tubes that indicate the measurement, along with measurement unit indications, and decimal point placement. Display time of the measurement, independent of gate time, is fixed at approximately 100 ms. The readout unit continuously displays the most recent measurement at the end of each gate time.

5.2 LOGIC DEVICES

Mother Board, Schematic #7-05355501, contains a list of typical integrated circuit devices found in this instrument.

5.3 CIRCUIT DESCRIPTIONS

In the following descriptions, abbreviated designators are used rather

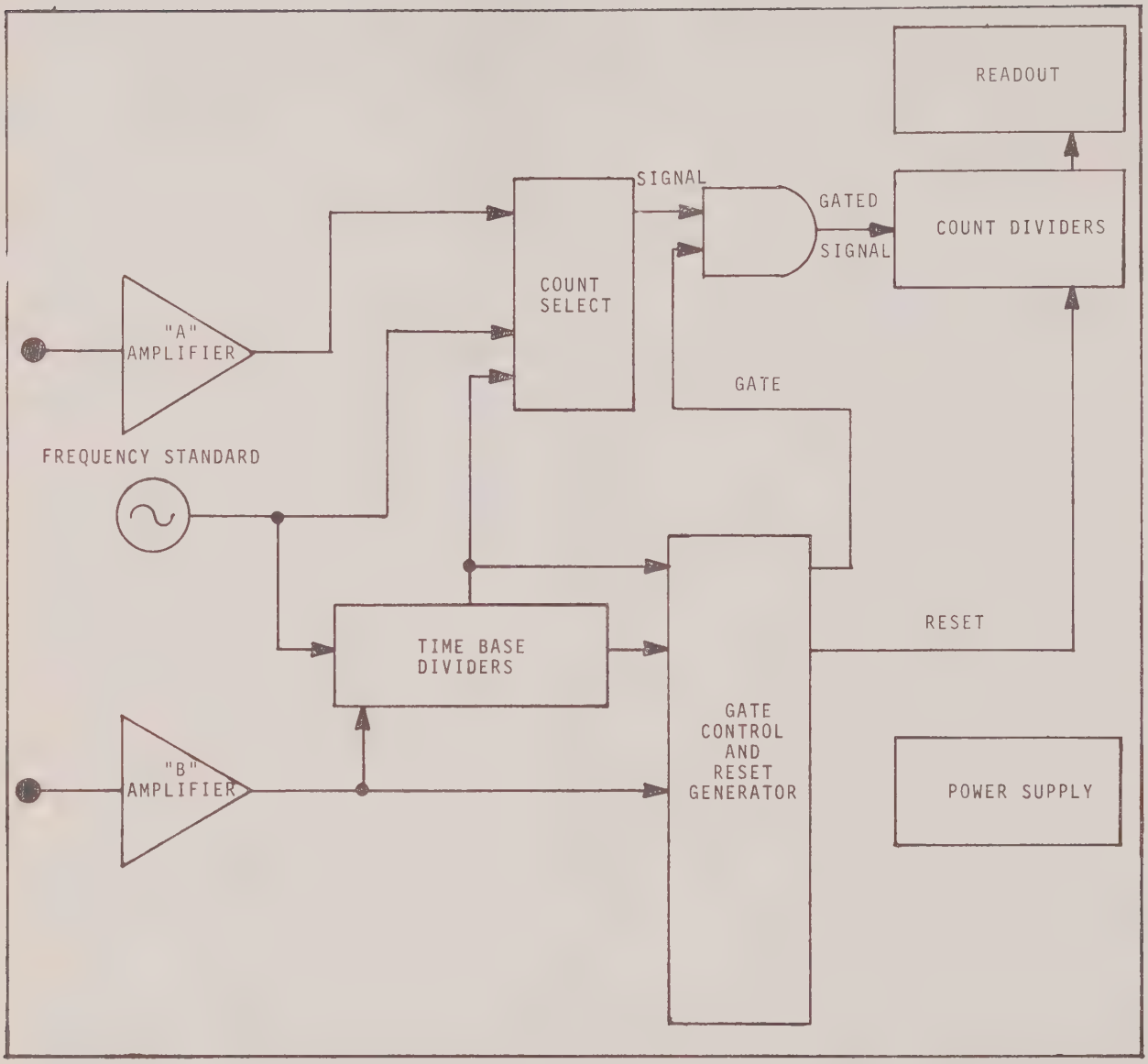


FIGURE 5.1 FUNCTIONAL BLOCK DIAGRAM

than full reference designation. For example, A1U6, on the Mother Board, is referred to as U6. Connector designators are referred to in the same manner. Pin 6 on connector J3 is referred to as J6-6. Interconnect wiring references are shown on Wiring Interconnect Schematic #7-053630.

5.3.1 Mother Board, A1, Schematic #7-05355501

The mother board assembly contains the power supply, time base, resolution select, control, count chain, multiplex, decimal and legend logic, off-scale, and gate light circuits. Although these are interdependent circuits, each has been described separately for purposes of clarity. See figures 5.2 and 5.3 for timing information.

Power Supply: The power supply circuit consists of the input filter, L, L2, C1, C2, the transformer, T1, mounted on the rear panel, and three full-wave rectifiers, with control and regulating circuitry. Outputs consist of +180 V, through Q1; unregulated +9 V, and regulated +5 V, and -12 V. The +9 V is regulated to +5 V through U1, and -18 V is regulated to -12 V through U2. +9 V is also used to charge the batteries when the LINE switch is in the off position and option 06 is installed.

Resolution Select: Resolution may be selected either manually or automatically. When using manual selection, each time the MAN switch on the front panel is actuated the resolution will step, in decades, from 100 Hz to 0.1 Hz. When the front panel AUTO switch is depressed, resolution is selected automatically by the logic circuits.

U58 is a binary counter element that is preprogrammed. Each pulse through pin 6 will change the output 1 binary bit. The programmed binary state will be transferred to the output when the strobe, pin 1, is held low. Sequentially depressing the manual switch fires the flip-flop, U56-3,6, through gate U55-11,8, stepping the binary output through the resolution ranges.

When using automatic resolution, U55-8 is disabled. The pulse through U63-3 clears U58, and, through U58-5 enables U62-6 and disables U46-11. U58 is preset so that the first pulse (start) through U48-9 will step U58 to the 100 Hz resolution position. Each following pulse will step the resolution one decade until 1 Hz resolution range is reached, unless the circuit is disabled. GATE U62-6 is disabled by one of two sources. The carry output from the next most-significant-digit through U56-11, U62-11 disables U62-6. When U49 is programmed to the 1 Hz resolution range, the outputs on U58-2,12, are gated through U55-3. The circuit consisting of U56-8 and exclusive OR gate U61-3 is both pulse sensitive and level sensitive.

Therefore, the level change at U55-3 will be gated through as a pulse, resetting U58-5, disabling U62-6. In either case, when U62-6 is disabled, U46-11 is enabled. The next pulse from U48-9 will be gated through U46-11 and applied to U38-1 as the stop pulse and the logic will be reset.

The binary output of U58 is routed to the time-base module, U57, and to the legend logic through storage module U49.

Time Base: The time base module is a programmable counter, U57. The binary output from U58 programs the output count and the 1 MHz signal from U62 provides the input. U62 is a decade divider which accepts the 10 MHz input from the oscillator. The output of U57 is applied to U48, a dual D edge flip-flop. The 1 MHz from U62 is applied to U48-11 as a synchronizing clock pulse. Therefore, the start signal, U48-9, is a pulse, <1 μs wide, synchronized to the 1 MHz clock input. The start pulse is gated through U46-8 to clock the control binaries U38, U35. This pulse is also gated through U46-6 to reset U48 so it can accept the next pulse from U57.

The output of U38-5 is gated through U42-8 to turn on the gate light and enable the second section of U38 to accept count pulses from U44-8. At this time both U46-8 and U46-11 are disabled. When U46-11 is enabled by U58-5, the next pulse through will provide the stop pulse. U38 can also accept start and stop pulse through the logic circuitry set up by the mode switches on the front panel.

Recycling of the instrument is accomplished by reset one-shot U50, C9. The fixed recycle rate is controlled by one-shot U50, C8. The transfer one-shot, U50, C10, updates the display at each end-of-count signal.

Decimal and Legend: Decimal information is selected by U49 and U41. The binary information from U58 is applied to U49 and stored until the enable pulse is applied. U41, BCD-to-decimal decoder, developes a one-of-ten condition to identify the decimal location. This information is fed through inverted NAND gates, U20, U23, U26, U34, and U37. The decoded information is sensed by U12 and U6, which provide the required drive for the indicators. Legend information is applied directly from the RATE A, TIM A→B, and PERIOD B switches.

Count Chain: The count chain consists of U13,16,19,22,25,28,33, and 36. These devices are tri-state counter-storage devices. U36 is the storage element and translator for the high speed decade, U38, U35. At reset the counters to the left of the decimal point are set at 15. The first pulse counted will change the output to "1" and the counters will then count from "1" through "0". Multiplex is accomplished by the free running oscillator U6, clock register U9, and decoder U10. The decoder times the sequence of multiplexing and the readout is interlaced multiplex for a proper visual indication. As each counter is strobed the "8" and "4" output lines are sensed by U4-6. If the "8" and "4" outputs are present a blanking pulse is applied to the four-to-seven segment decoder on the readout assembly.

OFF Scale: Off scale is sensed by U11, U7, and U3. When the most significant digit carries U11 toggles, setting flip-flop U7, U3. This output is held in storage until the next cycle. The next transfer pulse will drive U3-6 positive turning on the off scale light. The gate light drive, for extending the short time base condition, is provided by U67, C11. The true gate and extended gate are summed in U3-8 for proper drive to Q6.

5.3.2 Readout Assembly, A2, Schematic #45586-7-1

The readout assembly contains the display decoder driver, measurement units indicator, decimal decoder driver, off-scale indicator and gate indicator.

The readout display includes eight in-line horizontal tubes of the neon-filled cold-cathode discharge type. As the cathodes are grounded, the elements ionize the gas and produce the display. Current through the tubes is limited by the decoder driver, U2.

The decoder driver accepts a binary-coded decimal input, from the mother board, and converts the information to an output suitable for grounding the display tube cathodes. The blanking pulse is developed on the logic board by ANDing the BCD "4" and "8" together.

The anodes of the seven-segment readout tubes are activated by a sequenced level, timed to turn the various anodes on, applied to Q1,3, 5,7,9,11,13, and 15, at a time the cathodes are coded correctly. This multiplexing occurs at a frequency of approximately 2 kHz.

The measurement unit indicators, gate light, and off-scale light accept ground signals from logic elements on the mother board and convert them to a visual output on the annunciator unit.

The decimal driver, U1, accepts BCD information from the decimal logic and converts it to one-of-ten outputs suitable for lighting the decimals contained within the display tubes.

5.3.3 A Amplifier, A3, Schematic #7-05357201

The A amplifier contains the amplifier, attenuator, slope, and level circuits for the 20 Hz-50 MHz input.

The amplifier consists of a dual MOSFET, Q2, which provides impedance matching between the input signal and the following gain stages, Q3, Q4, Q5, and Q6. Input is through the voltage divider circuit, R11, C12, R12, C13, and R13, C14. The X1 switch position provides direct input. The X10 switch position is a 10-to-1 attenuation and the X100 position is a 100-to-1 attenuation over the X1 position. The output of the amplifier is applied to a SCHMITT trigger-shaper circuit on the mother board.

The level control varies the bias, through R27, at the base of Q6. The PRESET position is approximately the zero point of the level control. Clockwise rotation increases sensitivity.

The slope circuit applies either ground or +5 V dc to one input of an exclusive OR gate located on the mother board. In combination with the amplifier output signal, this supplies the start signal when in the TIM A→B or RATIO A÷B modes.

5.3.4 B Amplifier, A4, Schematic #7-05358401

Operation of the B amplifier is identical to the operation of the A amplifier. However, the SCHMITT trigger-shaper circuit is mounted on the amplifier assembly rather than the mother board.

5.3.5 10 MHz Oscillator Assembly, A5, Schematic #45608-7-1

The oscillator consists of a quartz crystal controlling a Colpitts circuit. This oscillator provides the standard frequency to which all unknown frequencies are compared. The output can be calibrated to a standard by adjusting the variable capacitor, C2.

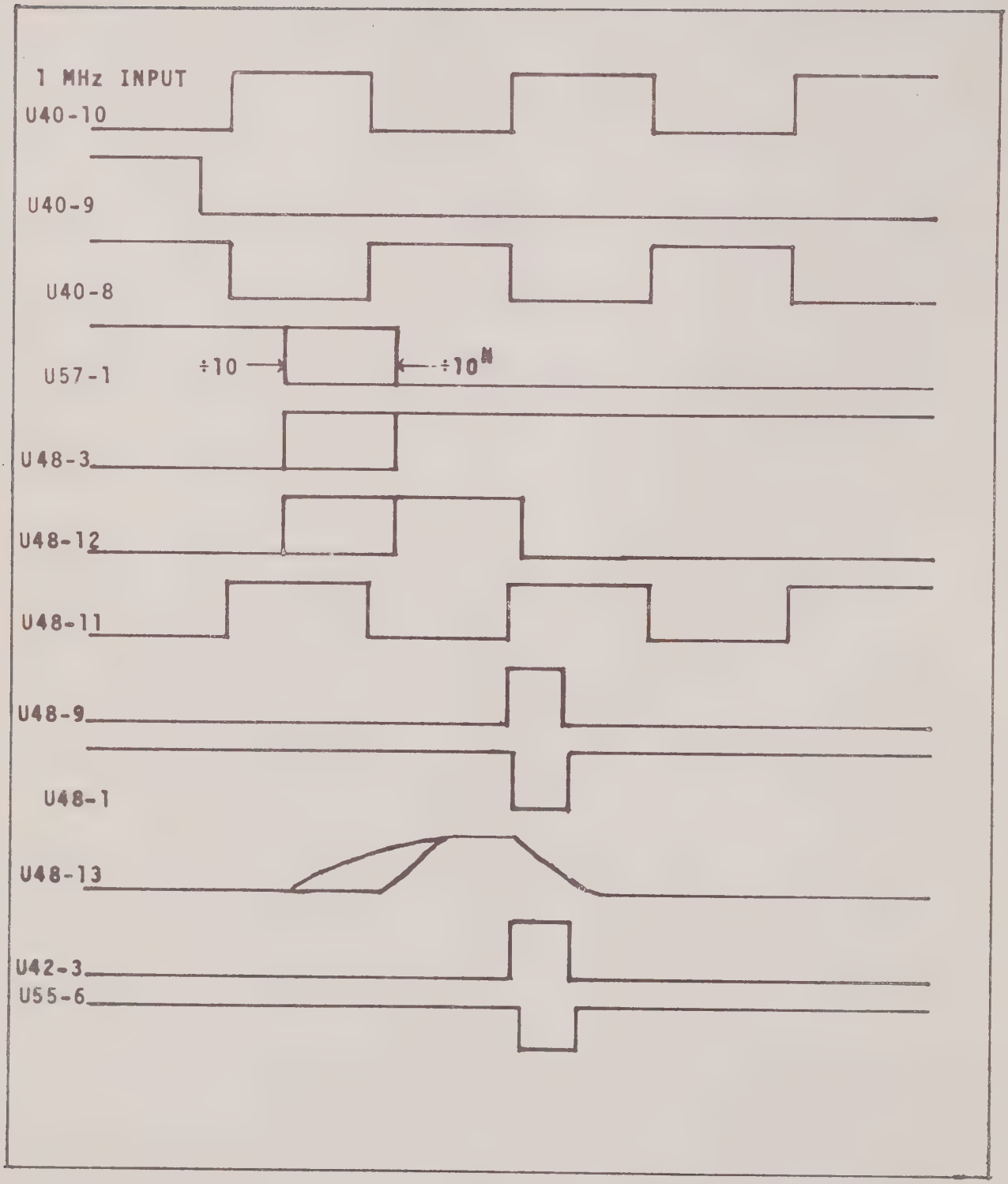


FIGURE 5.2 EXPANDED TIME BASE TIMING

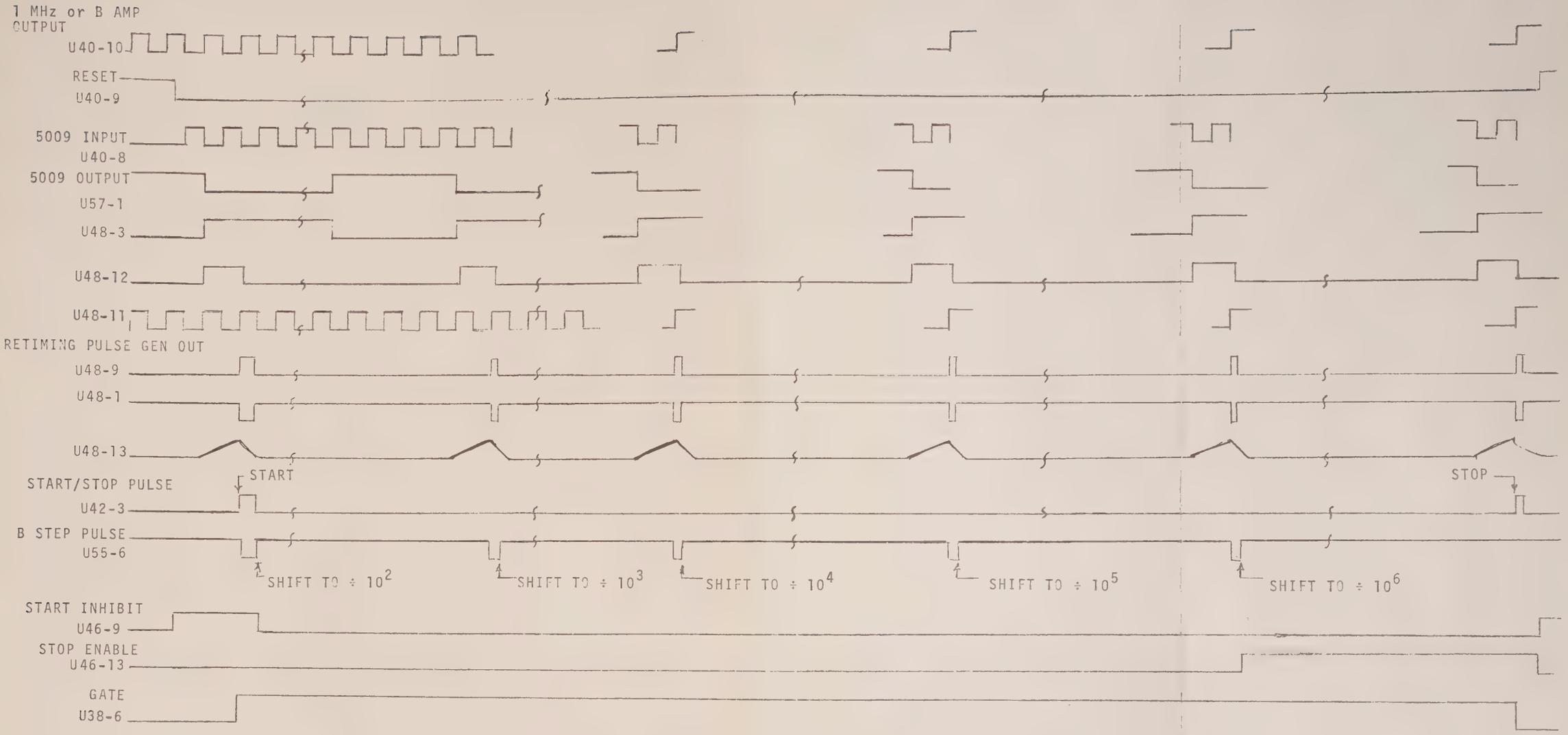
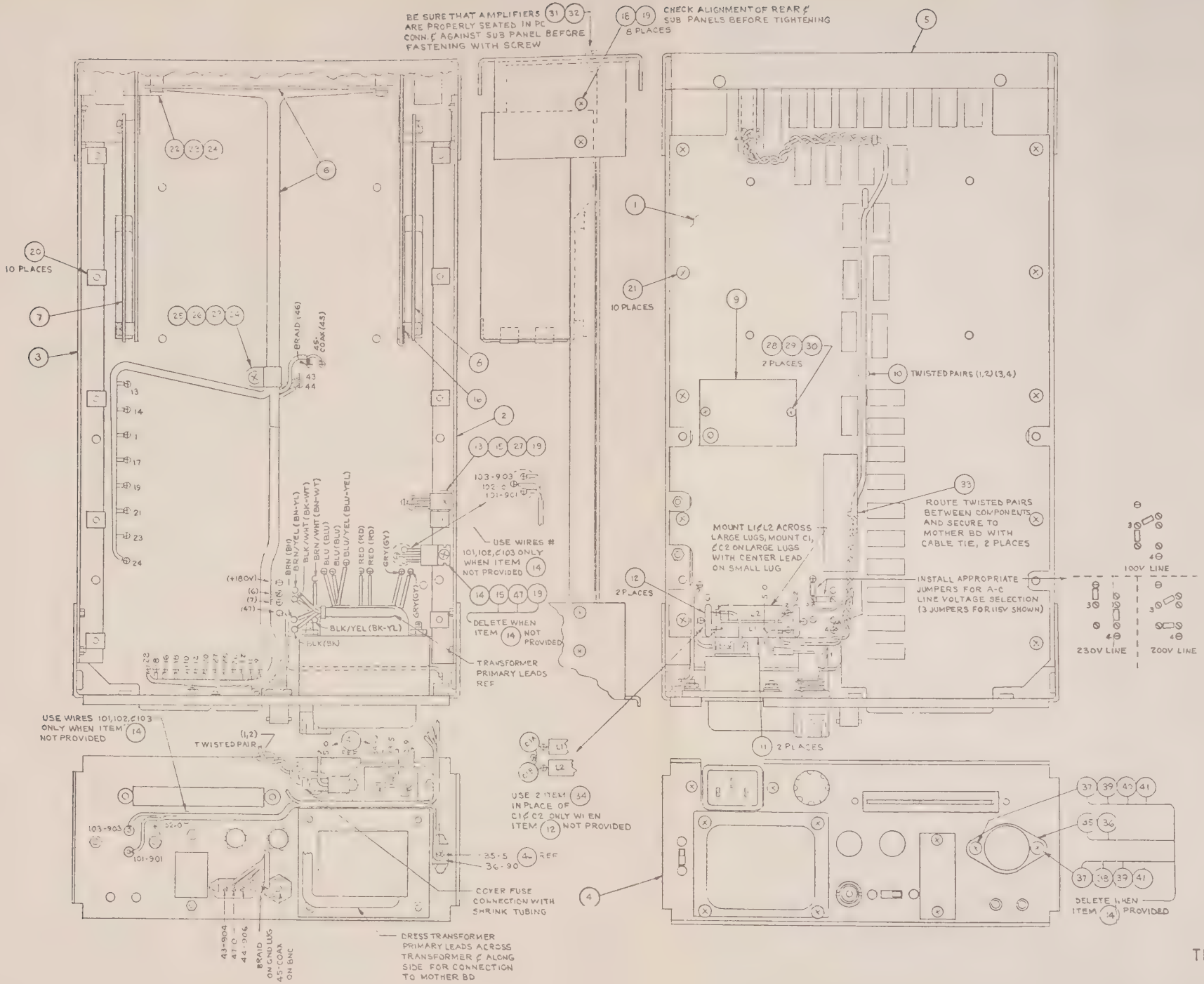


FIGURE 5.3 TIME BASE TIMING

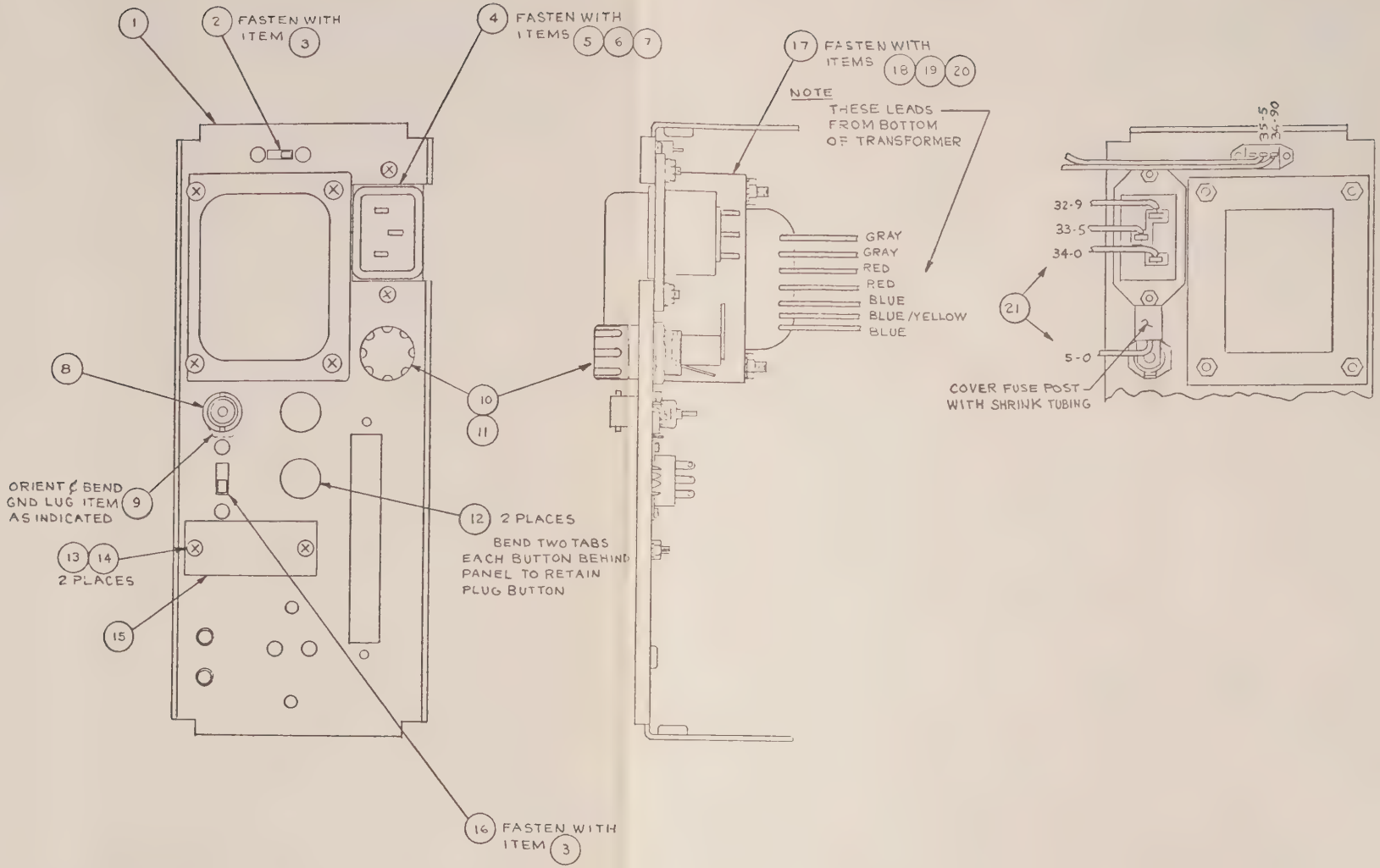
CHAPTER 6
DRAWINGS

6.1 INTRODUCTION

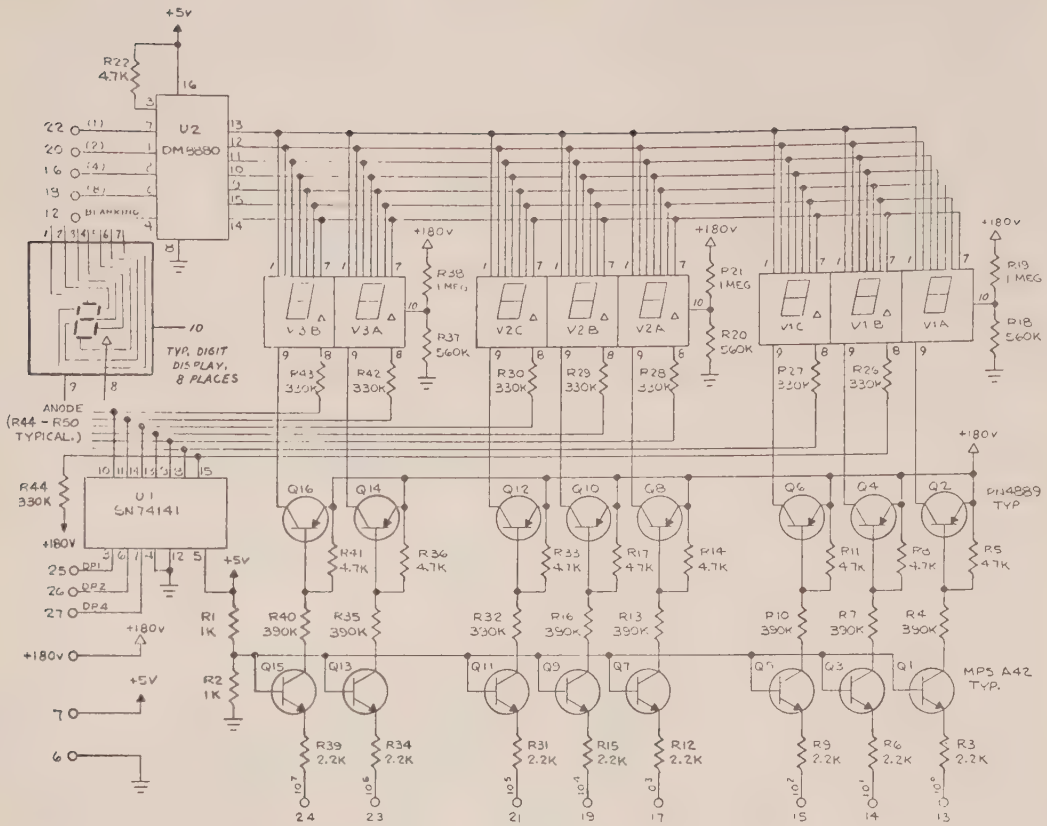
Assembly and schematic drawings are contained in this chapter. These are arranged with the Test Assembly, Rear Panel, and Wiring interconnect schematic followed by the A numbered boards arranged in Alpha-numeric order. The parts list in Chapter 7 is arranged in the same manner.

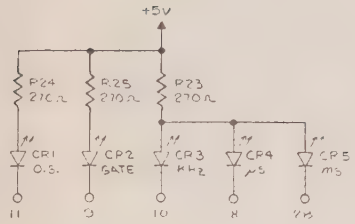

BE SURE THAT AMPLIFIERS (31) (32) ARE PROPERLY SEATED IN PC CONN. & AGAINST SUB PANEL BEFORE FASTENING WITH SCREW
(18) (19) CHECK ALIGNMENT OF REAR & SUB PANELS BEFORE TIGHTENING 8 PLACES
(20) 10 PLACES
(21) 10 PLACES
(12) 2 PLACES
(11) 2 PLACES
(28) (29) (30) 2 PLACES
(10) TWISTED PAIRS (1,2) (3,4)
(33) ROUTE TWISTED PAIRS BETWEEN COMPONENTS AND SECURE TO MOTHER BD WITH CABLE TIE, 2 PLACES
MOUNT L1 & L2 ACROSS LARGE LUGS, MOUNT C1, & C2 ON LARGE LUGS WITH CENTER LEAD ON SMALL LUG
INSTALL APPROPRIATE JUMPERS FOR A-C LINE VOLTAGE SELECTION (3 JUMPERS FOR 115V SHOWN)
100V LINE
230V LINE
200V LINE
BRAID (46)
45-COAX (45)
43
44
(13) (15) (27) (19)
103-903
102-0
101-901
USE WIRES # 101,102,&103 ONLY WHEN ITEM (14) NOT PROVIDED
BRN (BR)
BRN/YEL (BN-YL)
BLK/WHT (BK-WT)
BRN/WHT (BN-WT)
BLU (BLU)
BLU (BLU)
BLU/YEL (BLU-YEL)
RED (RD)
RED (RD)
GRY (GY)
(+180V)
(6)
(7)
(47)
GRY (GY)
BLK/YEL (BK-YL)
BLK (BK)
(14) (15) (47) (19)
DELETE WHEN ITEM (14) NOT PROVIDED
TRANSFORMER PRIMARY LEADS REF
USE WIRES 101,102,&103 ONLY WHEN ITEM (14) NOT PROVIDED
(1,2) TWISTED PAIR
103-903
102-0
101-901
35-5
36-90
(4) REF
COVER FUSE CONNECTION WITH SHRINK TUBING
43-904
47-0
44-906
BRAID ON GND LUG 45-COAX ON BNC
DRESS TRANSFORMER PRIMARY LEADS ACROSS TRANSFORMER & ALONG SIDE FOR CONNECTION TO MOTHER BD
L1
L2
USE 2 ITEM (34) IN PLACE OF C1 & C2 ONLY WHEN ITEM (12) NOT PROVIDED
(37) (39) (40) (41)
(35) (36)
(37) (38) (39) (41)
DELETE WHEN ITEM (14) PROVIDED

TEST ASSEMBLY #053629 REV A



REAR PANEL ASSEMBLY #053628 REV A



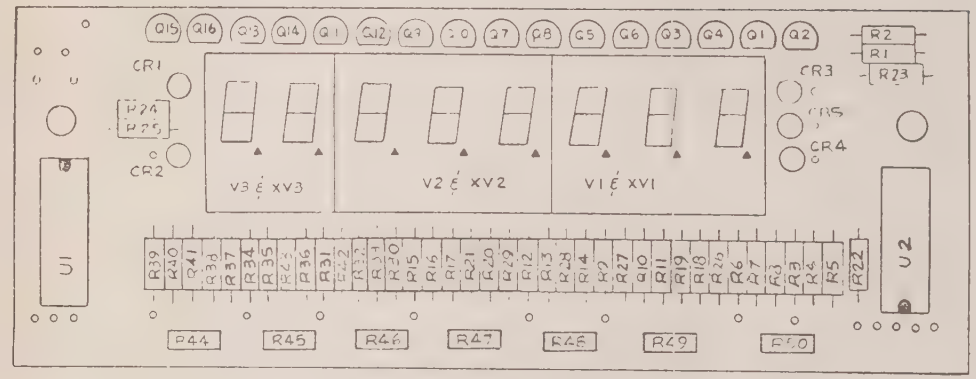


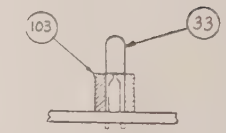
NOTES: UNLESS NOTED OTHERWISE

1) RESISTORS: 1/4W 5%

2) STROBE CODE = 1-4-7-2-5-8-6-3.

A2, READOUT SCHEMATIC #45586-7-1
REV B

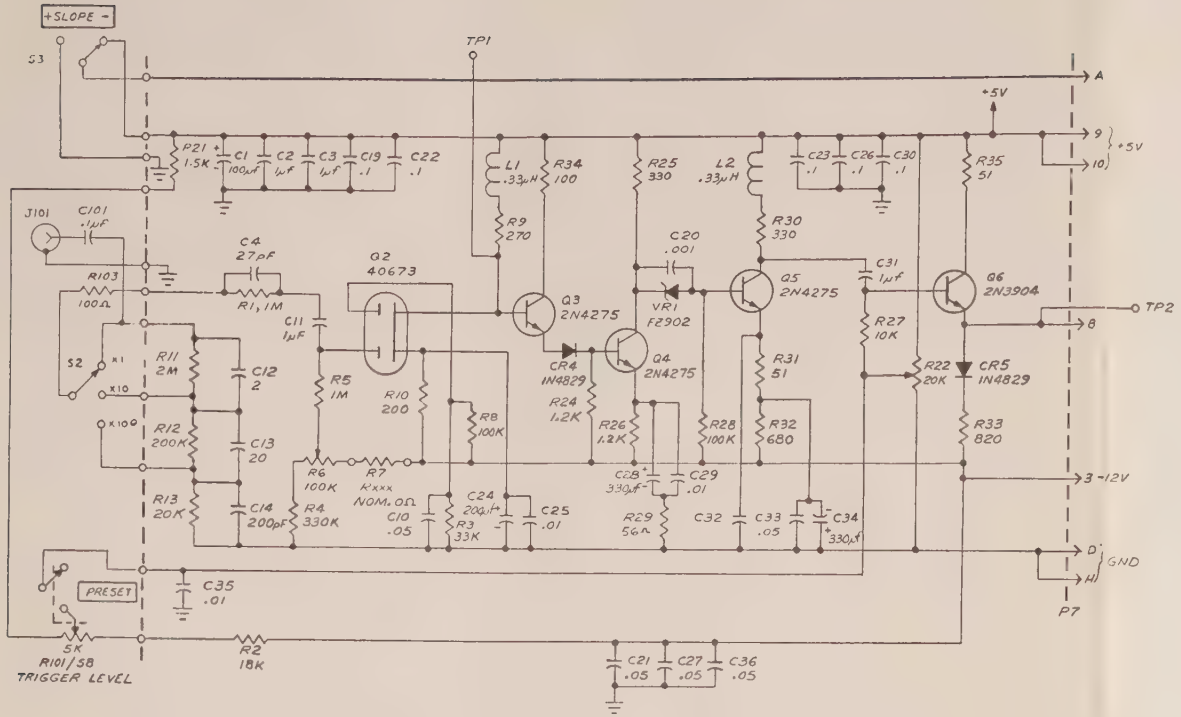




DETAIL B
TYP. ALL LED

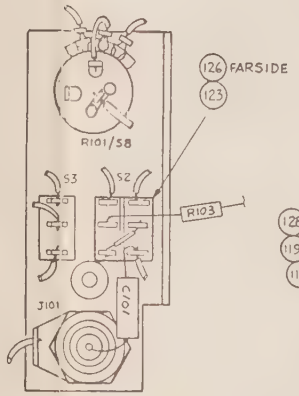
A2, READOUT ASSEMBLY #45586-4-1

REV B

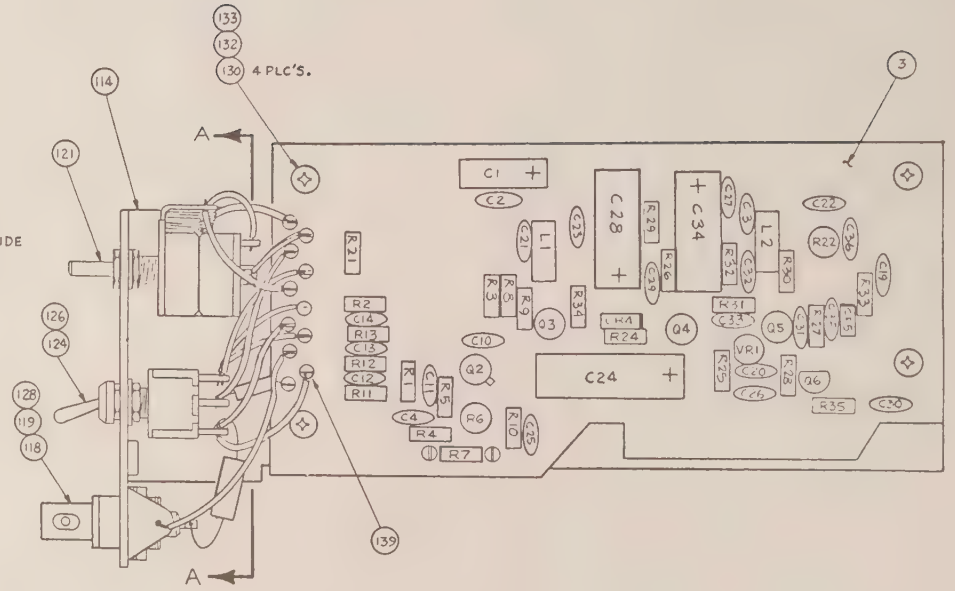


NOTES: UNLESS OTHERWISE SPECIFIED,
1. RESISTORS ARE IN OHMS 1/4W, 5%.
2. CAPACITOR VALUES MORE THAN ONE IN pF.
" " LESS " " µF.

A3, A AMPLIFIER SCHEMATIC #7-05357201
REV A

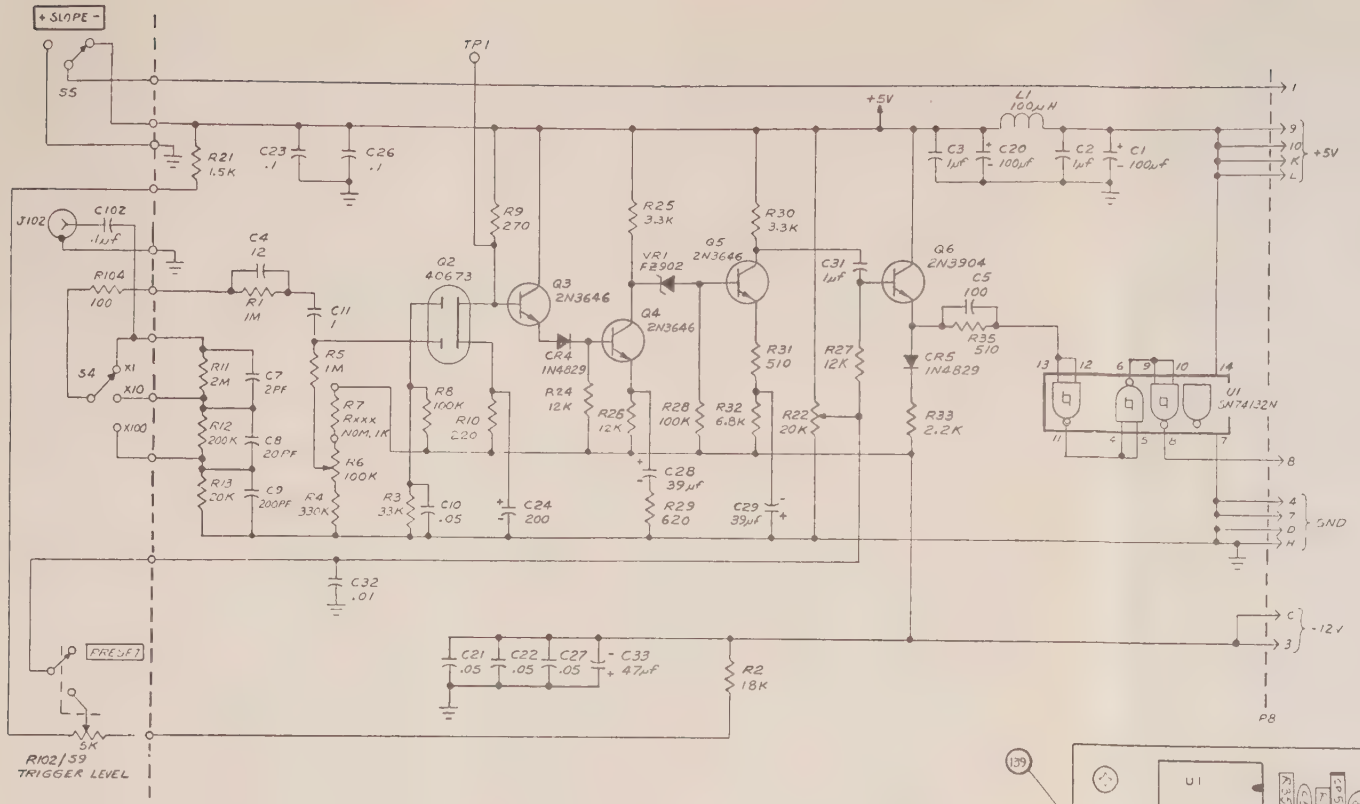


VIEW A-A



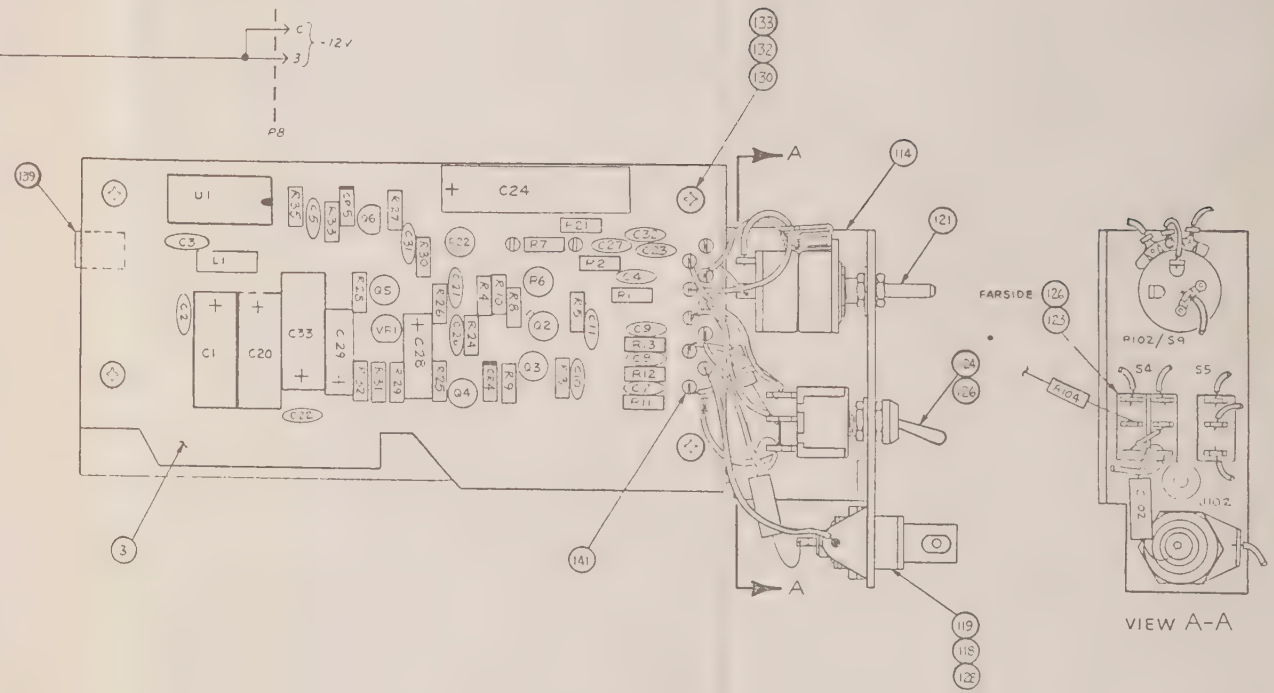
A3, A AMPLIFIER ASSEMBLY

#05357201 REV A

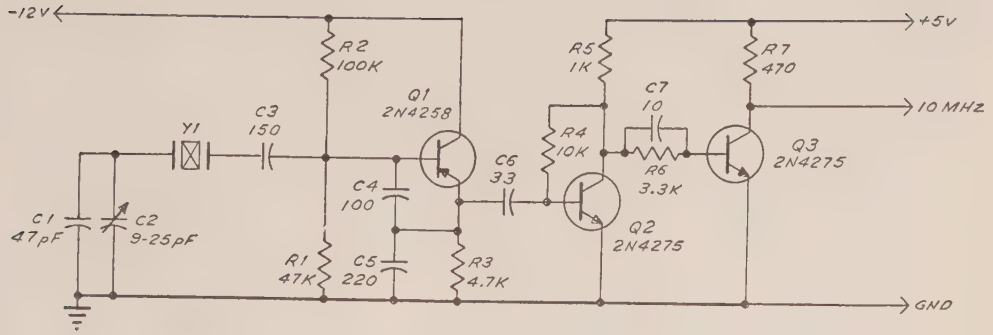


NOTES: UNLESS OTHERWISE SPECIFIED,
1. RESISTORS ARE IN OHMS 1/4W, 5%.
2. CAPACITORS VALUES MORE THAN ONE IN pF.
" " LESS " " μF.

A4, B AMPLIFIER SCHEMATIC #7-05358401
REV A



A4, B AMPLIFIER ASSEMBLY
#05358401 REV A

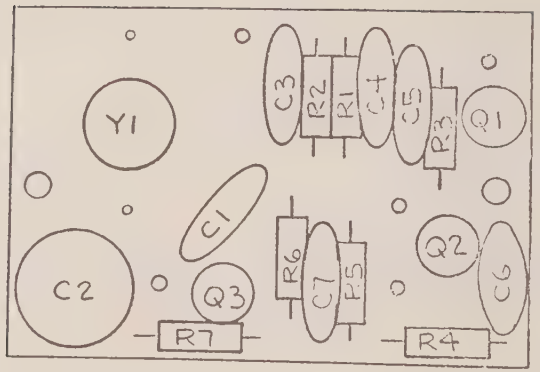


NOTE:

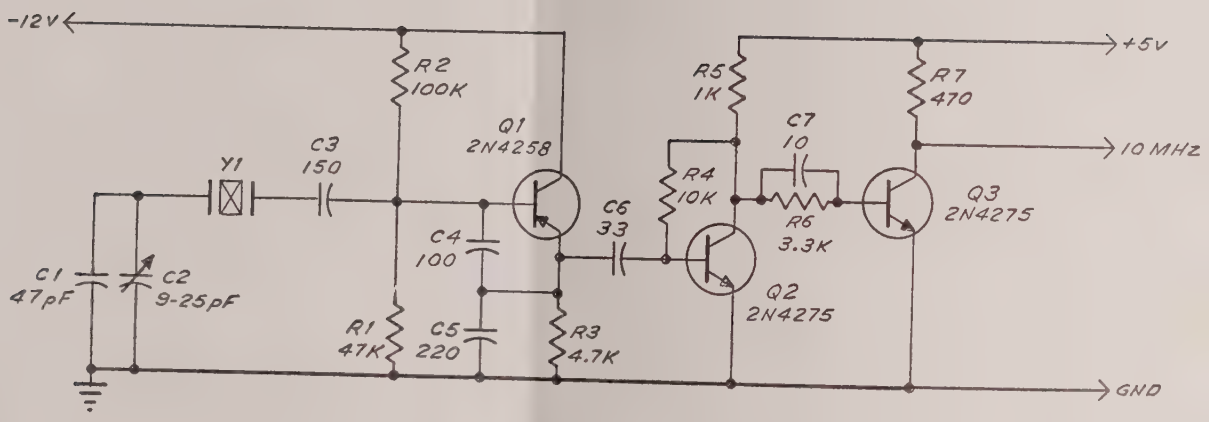
1) RESISTORS 1/4W, 5%.

2) CAPACITOR VALUES IN pF.

A5, 10 MHz OSCILLATOR SCHEMATIC
#45608-7-1 REV A



A5, 10 MHz OSCILLATOR ASSEMBLY
#45608-4-1 REV A

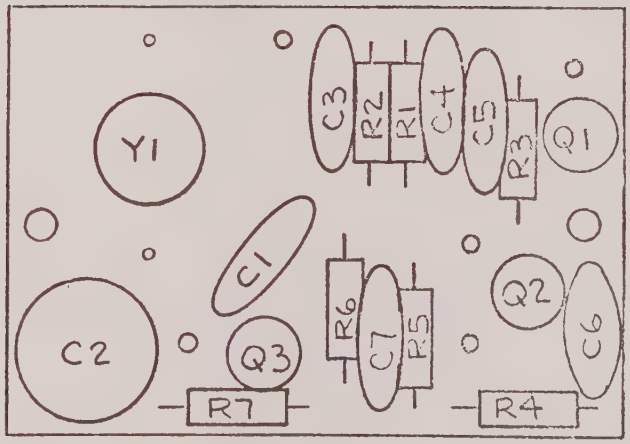


NOTE:

1) RESISTORS 1/4W, 5%.

2) CAPACITOR VALUES IN pF.

A5, 10 MHz OSCILLATOR SCHEMATIC
#45608-7-1 REV A



A5, 10 MHz OSCILLATOR ASSEMBLY

#45608-4-1 REV A

CHAPTER 7
PARTS LISTS

7.1 INTRODUCTION

The parts breakdown for the Model 6250A, Counter/Timer, is contained in this chapter. The parts lists are arranged with the final assembly followed by the sub-assemblies and the "A" numbered boards in order. A manufacturer's code-to-name index is contained in Table 7.1.

7.2 MANUFACTURER'S INDEX

TABLE 7.1 CODE-TO-NAME CROSS-REFERENCE

CODE	NAME	ADDRESS
00853	Sangamo Electric Co.	P.O. Box 128, Pickens, S. Carolina 29671
01121	Allen-Bradley Co.	1201 S. 2nd St., Milwaukee, Wis. 53204
01295	Texas Instrument Inc. Semiconductor & Components Division	13500 N. Central Expressway, Dallas Texas 75231
02735	RCA Corp. Solid State Div.	Route 202, Somerville, New Jersey 08876
03508	General Electric Co. Semiconductor Prod.	Electronics Park, Syracuse, N.Y. 13201
04713	Motorola Semiconductor Prod. Inc.	5005 E. McDowell Rd., Phoenix Arizona 85008
05574	Viking Industries Inc.	21001 Nordhoff, Chatsworth, Cal. 91311
06540	Amatom Electronic Div. of Mite Corp.	81 Rockdale Ave., New Rochelle New York 10806
06560	Airco Speer Electronics Div. of Air Reduction Co. Inc.	P.O. Box 1692, Nogales, Arizona 85621
06776	Robinson Nugent Inc.	P.O. Box 470, New Albany, Ind. 47150
07263	Fairchild Camer & Instr. Corp., Semiconductor Div.	313 Frontage Rd., Mt. View, Calif. 94040
09353	C & K Components Inc.	103 Morse, Newton, Mass. 02158

TABLE 7.1 CODE-TO-NAME CROSS-REFERENCE (Cont'd)

CODE	NAME	ADDRESS
13324	Herculite Protective Fabrics Inc.	1107 Broadway, New York, New York 10010
13715	Fairchild Camera & Inst. Semiconductor Div.	4300 Redwood Hwy., San Rafael, Calif. 94903
18324	Signetics Corp.	811 E. Arques, Sunnyvale, Calif. 94086
21604	Buckeye Stamping Co.	555 Marion Rd., Columbus, Ohio 43207
27014	National Semiconductor Corp.	2950 San Ysidro Way, Santa Clara, Calif. 95051
28480	Hewlett-Packard Co.	1501 Page Mill Rd., Palo Alto, Calif. 94304
34553	Amperex Electronic Corp. Component Div.	35 Hoffman Ave., Hauppauge, New York 11787
50088	Mostek Corp.	1400 Upfield Dr., Carrollton, Texas 75006
52542	Systron-Donner Corp.	10 Systron Dr., Concord, Calif. 94518
56289	Sprague Electronic Co.	North Adams, Mass. 01247
71590	Globe-Union Inc. Centralab Div.	P.O. Box 591, Milwaukee, Wis. 53201
72136	Electro Motive Mfg. Co., Inc.	South Park & John Sts., Willimantic Conn. 06226
72259	Nytronics Inc.	550 Springfield Ave., Berkeley Heights, New Jersey 07922
72982	Erie Technological Products Inc.	644 W. 12th St., Erie, Pa. 16512
74970	Johnson E.F., Co.	299 10th Ave, S.W., Waseca, Minn. 56093
75915	Littlefuse Inc.	800 E. Northwest Hwy., Des Plaines, Ill. 60016
76493	Miller J.W. Company	P.O. Box 5825, Compton, Calif. 90024
80294	Bourns Inc.	1200 Columbia Ave., Riverside, Calif. 92507
82389	Switchcraft Inc.	5555 N. Elstron Ave., Chicago, Ill. 60630
91418	Radio Materials Co.	4242 W. Bryn Mawr, Chicago, Ill. 60646

TABLE 7.1 CODE-TO-NAME CROSS-REFERENCE (Cont'd)

CODE	NAME	ADDRESS
99392	STM	2904 Chapman St., Oakland, Calif. 94601
99515	Marshall Industries Capacitor Division	1960 Walker Ave., Monrovia, Calif. 91016

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION FINAL ASSEMBLY #053630

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		SHIPPING ASSEMBLY #053630				
		ASSEMBLY, Test	52542	053629	053629	1
		PANEL, Decorative	52542	053561	053561	1
		BRACKET, Pushbutton Switch, Stop	52542	04565811	04565811	1
		LABEL, Identification, small	52542	037112	037112	1
		LENS, Molding	52542	04559361	04559361	1
		TRIM, Front	52542	03723061	03723061	2
		TRIM, End	52542	039033	039033	4
		SIDE, Extrusion	52542	03356403	03356403	4
		HANDLE	52542	03357003	03357003	2
		COVER, Side	52542	03376403	03376403	2
		COVER, Top	52542	03356703	03356703	1
		COVER, Bottom	52542	03382703	03382703	1
		BRACKET, Mounting	52542	039857	039857	4
		FEET, Set of 4	21604	PP40012&40013	101059	1
		COVER, Bottom	52542	03356803	03356803	1
		TEST ASSEMBLY #053629				
	A1	ASSEMBLY, Mother Board	52542	05355501	05355501	1
	A2	ASSEMBLY, Readout 8 Digit	52542	04574041	04574041	1
	A3	ASSEMBLY, A Amplifier	52542	05357201	05357201	1
	A4	ASSEMBLY, B Amplifier	52542	05358401	05358401	1
	A5	ASSEMBLY, 10 MHz Oscillator	52542	04560841	04560841	1
	C1	CAPACITOR, 2 X .005 µF, 1.4 kV, Disc	56289	125L2D50/29C147	102615	2
	C2	Same as C1				
	C1A	CAPACITOR, .005 µF, 1.4 kV, Disc	71590	C1-502	102823	4
	C1B	Same as C1A				
	C2A	Same as C1A				
	C2B	Same as C1A				
	L1	INDUCTOR, 100 µH, 20%	76493	5250	101328	2
	L2	Same as L1				
	Q2	TRANSISTOR, Silicon, PNP	04713	2N5193	101405	1
	U1	INTEGRATED CIRCUIT, Voltage Regulator	04713	MC7805CP	045256	1
		RAIL, Side, Left	52542	053565	053565	1
		RAIL, Side, Right	52542	053564	053564	1
		PANEL, Sub	52542	053562	053562	1
		REAR PANEL ASSEMBLY #053628				
		RECEPTICLE, BNC RF	52542	UG-1094/U	102409	1
		FUSE, Post 3AG	75915	342004	102409	1
		FUSE, 3AGMB	75915	312.500	100595	1
		COVER, Plate Connector	52542	02139811	02139811	1
		TRANSFORMER, Power	52542	053191	053191	1
		TRANSFORMER, End-Bell	52542	04561761	04561761	1
		CONNECTOR, Power, male	82389	EAC-301	101288	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A1, MOTHER BOARD ASSEMBLY #05355501

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		ASSEMBLY	52542	05355501	05355501	
		SCHEMATIC	52542	7-05355501	7-05355501	
	C1	Part of Test Assembly				
	C2	Part of Test Assembly				
	C3	CAPACITOR, El Ax, 20 µF, 350 V	56289	39D206F350FL4	100226	1
	C4	CAPACITOR, El Ax, 2000-4400 µF, 15 V	99392	33C15C1252	100247	1
	C5	CAPACITOR, El Ax, 250 µF, 25 V	34553	C437AR/F250	102614	1
	C6	CAPACITOR, Dip Mica, 100 pF, 500 V	72136	DM15FD101J0	10017301	1
	C7	CAPACITOR, Disc, .01 µF, 100 V	91418	TA110	100103	3
	C8	CAPACITOR, Tant, 4.7 µF, 35 V	56289	150D475X9035B2	100071	1
	C9	CAPACITOR, Disc, .05 µF, 10 V	71590	UK10-503	100122	12
	C10	CAPACITOR, Disc, .1 µF, 10 V	71590	UK10-104	100120	1
	C11	CAPACITOR, Disc, 1 µF, 25 V	56289	5C023105X0250B3	100176	4
	C12	CAPACITOR, Disc, .033 µF, 25 V	71590	UK25-33	100333	1
	C13	Same as C7				
	C14	Same as C9				
	C15	Same as C9				
	C16	Same as C7				
	C17	Same as C9				
	C18	Same as C9				
	C19	CAPACITOR, Disc, 1000 pF, 1 kV	91418	TYPE B	100076	4
	C20	Same as C9				
	C21	Same as C9				
	C22	Same as C9				
	C24	Same as C9				
	C25	CAPACITOR, Tant, 47 µF, 20 V	56289	150D476X9020R2	100186	1
	C26	CAPACITOR, Dip Mica, 22 pF, 500 V	72136	DM15ED220J0	100068	1
	C27	Same as C9				
	C28	Same as C11				
	C29	Same as C11				
	C30	Same as C19				
	C31	Same as C11				
	C32	CAPACITOR, El Ax, 100 µF, 25 V	56289	TE1211	100165	1
	C33	Same as C9				
	C34	Same as C19				
	C35	Same as C19				
	CR1	DIODE, Rectifier, 600 V	04713	1N4005	100413	10
	CR2	Same as CR1				
	CR3	Same as CR1				
	CR4	Same as CR1				
	CR5	Same as CR1				
	CR6	Same as CR1				
	CR7	Same as CR1				
	CR8	Same as CR1				
	CR9	Not Used				
	CR10	Same as CR1				
	CR11	Same as CR1				
	L1	Part of Test Assembly				
	L2	Part of Test Assembly				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A1, MOTHER BOARD ASSEMBLY #05355501 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	Q1	TRANSISTOR, Silicon, NPN	04713	MPS-A42	101421	1
	Q2	Part of Test Assembly				
	Q3	TRANSISTOR, Silicon, NPN	07263	2N4275	102716	2
	Q4	Same as Q3				
	Q5	TRANSISTOR, Silicon, NPN	07263	2N3646	101369	2
	Q6	Same as Q5				
	R1	RESISTOR, Comp, 100 k 5%, 1/4 W	01121	CB1045	101558	1
	R2	RESISTOR, Comp, 3 k 5%, 1/4 W	01121	CB3025	101548	2
	R3	Same as R2				
	R4	RESISTOR, Comp, 1 k 5%, 1/4 W	01121	CB1025	101569	4
	R5	RESISTOR, Comp, 3.6 k 5%, 1/4 W	01121	CB3625	101600	1
	R6	RESISTOR, Comp, 9.1 k 5%, 1/4 W	01121	CB9125	101573	1
	R7	Same as R4				
	R8	RESISTOR, Comp, 10 k 5%, 1/4 W	01121	CB1035	101570	1
	R9	RESISTOR, Comp, 3.3 k 5%, 1/4 W	01121	CB3325	101559	1
	R10	RESISTOR, Comp, 47 k 5%, 1/4 W	01121	CB4735	101574	4
	R11	Same as R10				
	R12	Same as R10				
	R13	Same as R10				
	R14	RESISTOR, Comp, 470 Ω 5%, 1/4 W	01121	CB4715	101625	4
	R15	RESISTOR, Comp, 56 k 5%, 1/4 W	01121	CB5635	101670	1
	R16	RESISTOR, Comp, 4.7 k 5%, 1/4 W	01121	CB4725	101598	6
	R17	Same as R16				
	R18	Same as R14				
	R19	RESISTOR, Comp, 510 Ω 5%, 1/4 W	01121	CB5115	101616	1
	R20	Same as R4				
	R21	Same as R14				
	R22	Same as R16				
	R23	Same as R14				
	R24	RESISTOR, Comp, 2.2 k 5%, 1/4 W	01121	CB2225	101562	1
	R25	Same as R16				
	R26	RESISTOR, Comp, 3.9 k 5%, 1/4 W	01121	CB3925	101601	1
	R27	RESISTOR, Comp, 510 k 5%, 1/2 W	01121	EB5145	101534	1
	R28	Same as R16				
	R29	RESISTOR, Comp, 220 Ω 5%, 1/4 W	01121	CB2215	101566	1
	R30	RESISTOR, Comp, 4.3 k 5%, 1/4 W	01121	CB4325	101546	1
	R31	Same as R16				
	R32	Same as R4				
	S1	SWITCH, 10 station	52542	04558961	04558961	1
	U1	Part of Test Assembly				
	U2	INTEGRATED CIRCUIT, Voltage Regulator	27014	LM723CN	025761	1
	U3	INTEGRATED CIRCUIT, Quad 2-input NAND gates, TTL	01295	SN7400N	019705	4
	U4	INTEGRATED CIRCUIT, Quad 2-input NAND gates, DTL	01295	SN15846N	019716	8
	U5	INTEGRATED CIRCUIT, Dual positive NOR periphral, TTL	01295	SN7545P	045292	1
	U6	INTEGRATED CIRCUIT, Timer, Wide Range LIN	13324	NE555V	045208	1
	U7	Same as U4				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A1, MOTHER BOARD ASSEMBLY #05355501 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	U8	INTEGRATED CIRCUIT, Dual 4-input NAND gates, DTL	01295	SN15830N	019712	2
	U9	INTEGRATED CIRCUIT, Binary Counter parallel set, TTL	18324	N8281A	025727	2
	U10	INTEGRATED CIRCUIT, BCD-Decimal Decoder TTL	01295	SN7442N	025749	2
	U11	INTEGRATED CIRCUIT, Dual D flip-flop TTL	01295	SN7474N	025241	3
	U12	Same as U8				
	U13	INTEGRATED CIRCUIT, Dec/Store Tri-State TTL	27014	DM85L52N	045212	7
	U14	Same as U4				
	U15	INTEGRATED CIRCUIT, Quad 2-input OR gates, DTL	04713	MC1808P	025734	8
	U16	Same as U13				
	U17	Same as U4				
	U18	INTEGRATED CIRCUIT, Quad 2-input NOR gates, DTL	04713	MC1810P	025735	1
	U19	Same as U13				
	U20	Same as U15				
	U21	INTEGRATED CIRCUIT, Quad 2-input AND gates, TTL	04713	MC3001P	025740	4
	U22	Same as U13				
	U23	Same as U15				
	U25	Same as U21				
	U25	Same as U13				
	U26	Same as U15				
	U27	Same as U15				
	U28	Same as U13				
	U29	INTEGRATED CIRCUIT, Quad 2-input NAND open, TTL	01295	SN7426N	045253	1
	U30	Same as U4				
	U31	Same as U15				
	U32	INTEGRATED CIRCUIT, Quad 2-input NOR gates, TTL	04713	MC3002P	025739	4
	U33	Same as U13				
	U34	Same as U15				
	U35	INTEGRATED CIRCUIT, Dec Counter/Latch TTL	01295	SN74196N	025784	1
	U36	INTEGRATED CIRCUIT, Quad D Reg Tri-State TTL	27014	DM85L51N	045210	1
	U37	Same as U11				
	U38	INTEGRATED CIRCUIT, Dual J-K flip-flop TTL	01295	SN74S112N	025786	1
	U39	INTEGRATED CIRCUIT, Decade Counter, TTL	01295	SN7490N	025732	1
	U40	Same as U32				
	U41	Same as U10				
	U42	INTEGRATED CIRCUIT, Quad 2-input OR gates, TTL	04713	MC3003P	025767	1
	U43	INTEGRATED CIRCUIT, Triple 3-input NAND gates, TTL	01295	SN7410N	019706	1
	U44	INTEGRATED CIRCUIT, Quad 2-input NAND gates, TTL	01295	SN74S00N	025785	1
	U45	Same as U3				
	U46	Same as U21				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A1, MOTHER BOARD ASSEMBLY #05355501 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	U47	Same as U3				
	U48	Same as U11				
	U49	INTEGRATED CIRCUIT, Quad Latch, TTL	01295	SN7475N	019710	1
	U50	INTEGRATED CIRCUIT, Dual one-shot multi TTL	01295	SN74123N	045209	2
	U51	Same as U3				
	U52	INTEGRATED CIRCUIT, 4 X 2-input NAND Schmitt, TTL	01295	SN74S132N	045271	1
	U53	INTEGRATED CIRCUIT, Dual positive OR periphral, TTL	01295	SN75453P	045291	1
	U54	INTEGRATED CIRCUIT, Dual positive AND periphral, TTL	01295	SN75451AP	045290	1
	U55	Same as U4				
	U56	Same as U4				
	U57	INTEGRATED CIRCUIT, Counter Time Base programmable, MOS	50088	MK5009 (Selected)	055093	1
	U58	Same as U9				
	U59	Same as U4				
	U60	Same as U32				
	U61	INTEGRATED CIRCUIT, Quad 2-input EXCL OR gates, TTL	04713	MC3021P	025789	1
	U62	Same as U32				
	U63	Same as U15				
	U64	INTEGRATED CIRCUIT, Quad 2-input AND gates, DTL	04713	MC1806P	025733	2
	U65	Same as U64				
	U66	Same as U21				
	U67	Same as U50				
	VR1	DIODE, Zener, 180 V	04713	1N991B	100461	1
	XA3	CONNECTOR, Edge, 10 positive Dual	05574	2VH10/1AV5	101165	2
	XA4	Same as XA3				
	XA5	CONNECTOR, Socket pin	06776	NS-430-25	101273	5

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A2, READOUT 8 DIGIT ASSEMBLY #45586-4-1

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	QTY
		ASSEMBLY	52542	45586-4-1	45586-4-1	
		SCHEMATIC	52542	45586-7-1	45586-7-1	
	CR1	DIODE, LED	28480	HPA 5082-4480	100460	5
	CR2	Same as CRL				
	CR3	Same as CR1				
	CR4	Same as CR1				
	CR5	Same as CR1				
	Q1	TRANSISTOR, Silicon, NPN	04713	MPS-A42	101421	8
	Q2	TRANSISTOR, Silicon, PNP	07263	PN4889-18	101422	8
	Q3	Same as Q1				
	Q4	Same as Q2				
	Q5	Same as Q1				
	Q6	Same as Q2				
	Q7	Same as Q1				
	Q8	Same as Q2				
	Q9	Same as Q1				
	Q10	Same as Q2				
	Q11	Same as Q1				
	Q12	Same as Q2				
	Q13	Same as Q1				
	Q14	Same as Q2				
	Q15	Same as Q1				
	Q16	Same as Q2				
	R1	RESISTOR, Comp, 1 k 5%, 1/4 W	01121	CB1025	101569	2
	R2	Same as R1				
	R3	RESISTOR, Comp, 2.2 k 5%, 1/4 W	01121	CB2225	101562	8
	R4	RESISTOR, Comp, 390 k 5%, 1/4 W	01121	CB3945	101787	8
	R5	RESISTOR, Comp, 4.7 k 5%, 1/4 W	01121	CB4725	101598	9
	R6	Same as R3				
	R7	Same as R4				
	R8	Same as R5				
	R9	Same as R3				
	R10	Same as R4				
	R11	Same as R5				
	R12	Same as R3				
	R13	Same as R4				
	R14	Same as R5				
	R15	Same as R3				
	R16	Same as R4				
	R17	Same as R5				
	R18	RESISTOR, Comp, 560 k 5%, 1/4 W	01121	CB5645	101687	3
	R19	RESISTOR, Comp, 1 M 5%, 1/4 W	01121	CB1055	101605	3
	R20	Same as R18				
	R21	Same as R19				
	R22	Same as R5				
	R23	RESISTOR, Comp, 270 Ω 5%, 1/4 W	01121	CB2715	101542	3
	R24	Same as R23				
	R25	Same as R23				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A2, READOUT 8 DIGIT ASSEMBLY #45586-4-1 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	R26	RESISTOR, Comp, 330 k 5%, 1/4 W	01121	CB3345	101658	14
	R27	Same as R26				
	R28	Same as R26				
	R29	Same as R26				
	R30	Same as R26				
	R31	Same as R3				
	R32	Same as R4				
	R33	Same as R5				
	R34	Same as R3				
	R35	Same as R4				
	R36	Same as R5				
	R37	Same as R18				
	R38	Same as R19				
	R39	Same as R3				
	R40	Same as R4				
	R41	Same as R5				
	R42	Same as R26				
	R43	Same as R26				
	R44	Same as R26				
	R45	Same as R26				
	R46	Same as R26				
	R47	Same as R26				
	R48	Same as R26				
	R49	Same as R26				
	R50	Same as R26				
	U1	INTEGRATED CIRCUIT, Decoder Driver, TTL	01295	SN74141N	025730	1
	U2	INTEGRATED CIRCUIT, Segment Dec/Driver TTL	52542	DD700	045203	1
	V1	DISPLAY, 7 segment, 3 characters	52542	SP-333	102401	2
	V2	Same as V1				
	V3	DISPLAY, 7 segment, 2 characters	52542	SP-332	102400	1
	XV1	SOCKET, Display, 3 characters	52542	CS-333	102443	2
	XV2	Same as XV1				
	XV3	SOCKET, Display, 2 characters	52542	CS-332	102444	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A3, A AMPLIFIER ASSEMBLY #05357201

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		ASSEMBLY	52542	05357201	05357201	
		SCHEMATIC	52542	7-05357201	7-05357201	
	C1	CAPACITOR, Tant, 100 µF, 10 V	56289	150D107X9010R2	100119	1
	C2	CAPACITOR, Disc, 1 µF, 25 V	56289	5C023105X0250B3	100176	4
	C3	Same as C2				
	C4	CAPACITOR, Dip Mica, 27 pF, 500 V	72136	DM15ED270J0	102545	1
	C5	Not Used				
	C6	Not Used				
	C7	Not Used				
	C8	Not Used				
	C9	Not Used				
	C10	CAPACITOR, Disc, .05 µF, 10 V	71590	UK10-503	100122	5
	C11	Same as C2				
	C12	CAPACITOR, Dip Mica, 2 pF, 500 V	72136	DM15CD020D0	102542	1
	C13	CAPACITOR, Dip Mica, 20 pF, 500 V	72136	DM15ED200J0	102544	1
	C14	CAPACITOR, Dip Mica, 200 pF, 500 V	72136	DM15FD201J0	102576	1
	C15	Not Used				
	C16	Not Used				
	C17	Not Used				
	C18	Not Used				
	C19	CAPACITOR, Disc, .1 µF, 10 V	71590	UK10-104	100120	5
	C20	CAPACITOR, Disc, 1000 pF 1 kV	91418	TYPE B	100076	1
	C21	Same as C10				
	C22	Same as C19				
	C23	Same as C19				
	C24	CAPACITOR, El Ax, 200 µF, 15 V	56289	TE1164	100196	1
	C25	CAPACITOR, Disc, .01 µF, 100 V	91418	TA110	100103	3
	C26	Same as C19				
	C27	Same as C10				
	C28	CAPACITOR, Tant, 330 µF, 6 V	56289	150D337X0006S2	100188	2
	C29	Same as C25				
	C30	Same as C19				
	C31	Same as C2				
	C32	CAPACITOR, Dip Mica, 47 pF, 500 V	72136	DM15ED470J0	100171	1
	C33	Same as C10				
	C34	Same as C28				
	C35	Same as C25				
	C36	Same as C10				
	C101	CAPACITOR, Metmyl, .1 µF, 600 V	99515	D6-104	100158	1
	CR1	Not Used				
	CR2	Not Used				
	CR3	Not Used				
	CR4	DIODE, Signal, 20 V	03508	1N4829	100443	2
	CR5	Same as CR4				
	J101	RECEPTICLE, BNC RF	52542	UG-1094A/U	101170	1
	L1	INDUCTOR, Fixed	06560	4416-7K	101324	2
	L2	Same as L1				
	Q1	Not Used				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A3, A AMPLIFIER ASSEMBLY #05357201 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	Q2	TRANSISTOR, MOSFET N-channel, dual gate	02735	40673	101402	1
	Q3	TRANSISTOR, Silicon, NPN	07263	2N4275	102716	3
	Q4	Same as Q3				
	Q5	Same as Q3				
	Q6	TRANSISTOR, Silicon, NPN	04713	2N3904	101377	1
	R1	RESISTOR, Comp, 1 M 5%, 1/4 W	01121	CB1055	101605	2
	R2	RESISTOR, Comp, 18 k 5%, 1/4 W	01121	CB1835	101579	1
	R3	RESISTOR, Comp, 33 k 5%, 1/4 W	01121	CB3335	101576	1
	R4	RESISTOR, Comp, 330 k 5%, 1/4 W	01121	CB3345	101658	1
	R5	Same as R1				
	R6	RESISTOR, Potentiometer, Ceramic: 4-turn, 100 k 20%, 1/2 W, top adjust	80294	3339H-1-104	102298	1
	R7	RESISTOR, Nominal, 0 Ω 5%, 1/4 W		L-2007-1	102879	1
	R8	RESISTOR, Comp, 100 k 5%, 1/4 W	01121	CB1045	101558	2
	R9	RESISTOR, Comp, 270 Ω 5%, 1/4 W	01121	CB2715	101542	1
	R10	RESISTOR, Comp, 200 Ω 5%, 1/4 W	01121	CB2015	101555	1
	R11	RESISTOR, Comp, 2 M 5%, 1/4 W	01121	CB2055	101691	1
	R12	RESISTOR, Comp, 200 k 5%, 1/4 W	01121	CB2045	101586	1
	R13	RESISTOR, Comp, 20 k 5%, 1/4 W	01121	CB2035	101607	1
	R14	Not Used				
	R15	Not Used				
	R16	Not Used				
	R17	Not Used				
	R18	Not Used				
	R19	Not Used				
	R20	Not Used				
	R21	RESISTOR, Comp, 1.5 k 5%, 1/4 W	01121	CB1525	101577	1
	R22	RESISTOR, Potentiometer, Ceramic: 4-turn, 20 k 20%, 1/2 W, top adjust	80294	3339H-1-203	102299	1
	R23	Not Used				
	R24	RESISTOR, Comp, 1.2 k 5%, 1/4 W	01121	CB1225	101581	2
	R25	RESISTOR, Comp, 330 Ω 5%, 1/4 W	01121	CB3315	101536	2
	R26	Same as R24				
	R27	RESISTOR, Comp, 10 k 5%, 1/4 W	01121	CB1035	101570	1
	R28	Same as R8				
	R29	RESISTOR, Comp, 56 Ω 5%, 1/4 W	01121	CB5605	101735	1
	R30	Same as R25				
	R31	RESISTOR, Comp, 51 Ω 5%, 1/4 W	01121	CB5105	101672	2
	R32	RESISTOR, Comp, 680 Ω 5%, 1/4 W	01121	CB6815	101669	1
	R33	RESISTOR, Comp, 820 Ω 5%, 1/4 W	01121	CB8215	101567	1
	R34	RESISTOR, Comp, 100 Ω 5%, 1/4 W	01121	CB1015	101609	2
	R35	Same as R31				
	R101/S8	RESISTOR, Potentiometer w/switch, 5 k	52542	/MALLORY MLC/	101846	1
	R103	Same as R34				
	S2	SWITCH, Toggle DPDT	09353	7211	102350	1
	S3	SWITCH, Toggle SPDT	09353	7101	102310	1
	VR1	DIODE, Zener, 6.5 V	13715	FZ902	102736	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A4, B AMPLIFIER ASSEMBLY #05358401

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		ASSEMBLY	52542	05358401	05358401	
		SCHEMATIC	52542	7-05358401	7-05358401	
	C1	CAPACITOR, Tant, 100 µF, 10 V	56289	150D107X9010R2	100119	2
	C2	CAPACITOR, Disc, 1 µF, 25 V	56289	5C023105X0250B3	100176	4
	C3	Same as C2				
	C4	CAPACITOR, Dip Mica, 12 pF, 500 V	72136	DM15CD120J0	100240	1
	C5	CAPACITOR, Dip Mica, 100 pF, 500 V	72136	DM15FD101J0	100173	1
	C6	Not Used				
	C7	CAPACITOR, Dip Mica, 2 pF, 500 V	72136	DM15CD020D0	102542	1
	C8	CAPACITOR, Dip Mica, 20 pF, 500 V	72136	DM15ED200J0	102544	1
	C9	CAPACITOR, Dip Mica, 200 pF, 500 V	72136	DM15FD201J0	102576	1
	C10	CAPACITOR, Disc, .05 µF, 10 V	71590	UK10-503	100122	4
	C11	Same as C2				
	C12	Not Used				
	C13	Not Used				
	C14	Not Used				
	C15	Not Used				
	C16	Not Used				
	C17	Not Used				
	C18	Not Used				
	C19	Not Used				
	C20	Same as C1				
	C21	Same as C10				
	C22	Same as C10				
	C23	CAPACITOR, Disc, .1 µF, 10 V	71590	UK10-104	100120	2
	C24	CAPACITOR, El Ax, 200 µF, 15 V	56289	TE1164	100196	1
	C25	Not Used				
	C26	Same as C23				
	C27	Same as C10				
	C28	CAPACITOR, Tant, 39 µF, 10 V	56289	150D396X9010B2	100183	2
	C29	Same as C28				
	C30	Not Used				
	C31	Same as C2				
	C32	CAPACITOR, Disc, .01 µF, 100 V	91418	TA110	100103	1
	C33	CAPACITOR, Tant, 47 µF, 20 V	56289	150D476X9020R2	100186	1
	C102	CAPACITOR, Metmyl, .1 µF, 600 V	99515	D6-104	100158	1
	CR1	Not Used				
	CR2	Not Used				
	CR3	Not Used				
	CR4	DIODE, Zener, 6.5 V	13715	FZ902	100443	2
	CR5	Same as CR4				
	J102	RECEPTICLE, BNC RF	52542	UG-1094A/U	101170	1
	L1	INDUCTOR, Fixed, 100 µH	72259	WEE-100	101306	1
	Q1	Not Used				
	Q2	TRANSISTOR, MOSFET N-channel, dual gate	02735	40673	1-1402	1
	Q3	TRANSISTOR, Silicon, NPN	07263	2N3646	101369	3
	Q4	Same as Q3				
	Q5	Same as Q3				
	Q6	TRANSISTOR, Silicon, NPN	04713	2N3904	101377	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A4, B AMPLIFIER ASSEMBLY #05358401 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	R1	RESISTOR, Comp, 1 M 5%, 1/4 W	01121	CB1055	101605	2
	R2	RESISTOR, Comp, 18 k 5%, 1/4 W	01121	CB1835	101579	1
	R3	RESISTOR, Comp, 33 k 5%, 1/4 W	01121	CB3335	101576	1
	R4	RESISTOR, Comp, 330 k 5%, 1/4 W	01121	CB3345	101658	1
	R5	Same as R1				
	R6	RESISTOR, Potentiometer, Ceramic: 4-turn, 100 k 20%, 1/2 W, top adjust	80294	3339H-1-104	102298	1
	R7	RESISTOR, Comp, 1 k 5%, 1/4 W	01121	CB1025	101569	1
	R8	RESISTOR, Comp, 100 k 5%, 1/4 W	01121	CB1045	101558	2
	R9	RESISTOR, Comp, 270 Ω 5%, 1/4 W	01121	CB2715	101542	1
	R10	RESISTOR, Comp, 220 Ω 5%, 1/4 W	01121	CB2215	101566	1
	R11	RESISTOR, Comp, 2 M 5%, 1/4 W	01121	CB2055	101691	1
	R12	RESISTOR, Comp, 200 k 5%, 1/4 W	01121	CB2045	101586	1
	R13	RESISTOR, Comp, 20 k 5%, 1/4 W	01121	CB2035	101607	1
	R14	Not Used				
	R15	Not Used				
	R16	Not Used				
	R17	Not Used				
	R18	Not Used				
	R19	Not Used				
	R20	Not Used				
	R21	RESISTOR, Comp, 1.5 k 5%, 1/4 W	01121	CB1525	101577	1
	R22	RESISTOR, Potentiometer, Ceramic: 4-turn, 20 k 20%, 1/2 W, top adjust	80294	3339H-1-203	102299	1
	R23	Not Used				
	R24	RESISTOR, Comp, 12 k 5%, 1/4 W	01121	CB1235	101565	3
	R25	RESISTOR, Comp, 3.3 k 5%, 1/4 W	01121	CB3325	101559	2
	R26	Same as R24				
	R27	Same as R24				
	R28	Same as R8				
	R29	RESISTOR, Comp, 620 Ω 5%, 1/4 W	01121	CB6215	101688	1
	R30	Same as R25				
	R31	RESISTOR, Comp, 510 Ω 5%, 1/4 W	01121	CB5115	101616	2
	R32	RESISTOR, Comp, 6.8 k 5%, 1/4 W	01121	CB6825	101544	1
	R33	RESISTOR, Comp, 2.2 k 5%, 1/4 W	01121	CB2225	101562	1
	R34	Not Used				
	R35	Same as R31				
	R102/S9	RESISTOR, Potentiometer w/switch, 5 k	52542	/MALLORY MLC/	101846	1
	R104	RESISTOR, Comp, 100 Ω 5%, 1/4 W	01121	CB1015	101609	1
	S4	SWITCH, Toggle DPDT	09353	7211	102350	1
	S5	SWITCH, Toggle SPDT	09353	u101	102310	1
	U1	INTEGRATED CIRCUIT, 4 X 2-input NAND Schmitt, TTL	01295	SN74132N	045270	1
	VR1	DIODE, Zener, 6.5 V	13715	FZ902	102736	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A5, 10 MHz OSCILLATOR ASSEMBLY #45608-4-1

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		ASSEMBLY	52542	45608-4-1	45608-4-1	
		SCHEMATIC	52542	45608-7-1	45608-7-1	
	C1	CAPACITOR, Dip Mica, 47 pF, 500 V	72136	DM15ED470J0	10017101	1
	C2	CAPACITOR, Varcer, 9.0-35 pF	72982	538-011D9.0-35	100135	1
	C3	CAPACITOR, Dip Mica, 150 pF, 500 V	72136	DM15FD151J0	10021901	1
	C4	CAPACITOR, Dip Mica, 100 pF, 500 V	72136	DM15FD101J0	10017301	1
	C5	CAPACITOR, Dip Mica, 220 pF, 500 V	72136	DM15FD221J0	10022001	1
	C6	CAPACITOR, Dip Mica, 33 pF, 500 V	72136	DM15ED330J0	10017501	1
	C7	CAPACITOR, Dip Mica, 10 pF, 500 V	72136	DM15CD100J0	10025301	1
	Q1	TRANSISTOR, Silicon, PNP	07263	2N4258	102675	1
	Q2	TRANSISTOR, Silicon, NPN	07263	2N4275	102716	2
	Q3	Same as Q2				
	R1	RESISTOR, Comp, 47 k 5%, 1/4 W	01121	CB4735	101574	1
	R2	RESISTOR; Comp, 100 k 5%, 1/4 W	01121	CB1045	101558	1
	R3	RESISTOR, Comp, 4.7 k 5%, 1/4 W	01121	CB4725	101598	1
	R4	RESISTOR, Comp, 10 k 5%, 1/4 W	01121	CB1035	101570	1
	R5	RESISTOR, Comp, 1 k 5%, 1/4 W	01121	CB1025	101569	1
	Y1	CRYSTAL, 10.0 MHz	52542	039483	039483	1

CHAPTER 8
OPTIONS

8.1 INTRODUCTION

This chapter contains the circuit description, assembly/schematic drawings, and parts lists for the standard options available with the instrument. The options are arranged in numerical sequence in a package format. The circuit description, followed by the assembly/schematic drawings and the parts list. Pages are numbered with the option number followed by the page number, ie; page three of option six is numbered OPT 06-3. Where options are similar, the description, drawings and parts lists are combined in one package.

CIRCUIT DESCRIPTION
OPTION 06 AND OPTION 07
FINAL ASSEMBLY #045836/045834

DESCRIPTION

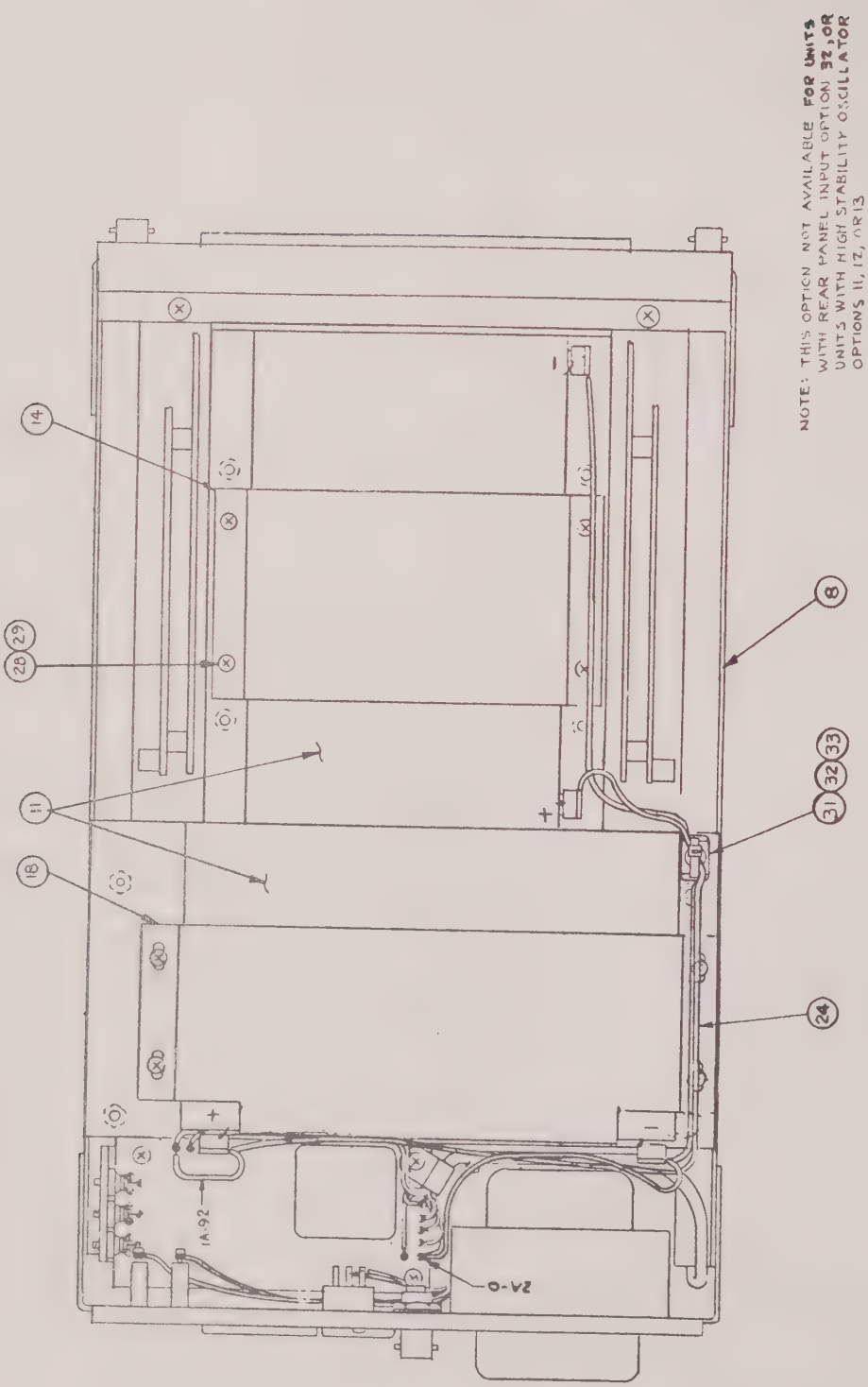
Option 06, final assembly #045836, provides independent portable operation of approximately three hours from an internal 6 V battery pack. An internal battery charger and power inverter circuitry are included in the option.

Option 07, final assembly #045834, provides portable operation of the counter with the use of an external battery or a 5.5 to 7.5 V dc power source. External, banana type, jacks and plugs are provided for external connections and power inverter circuitry is provided.

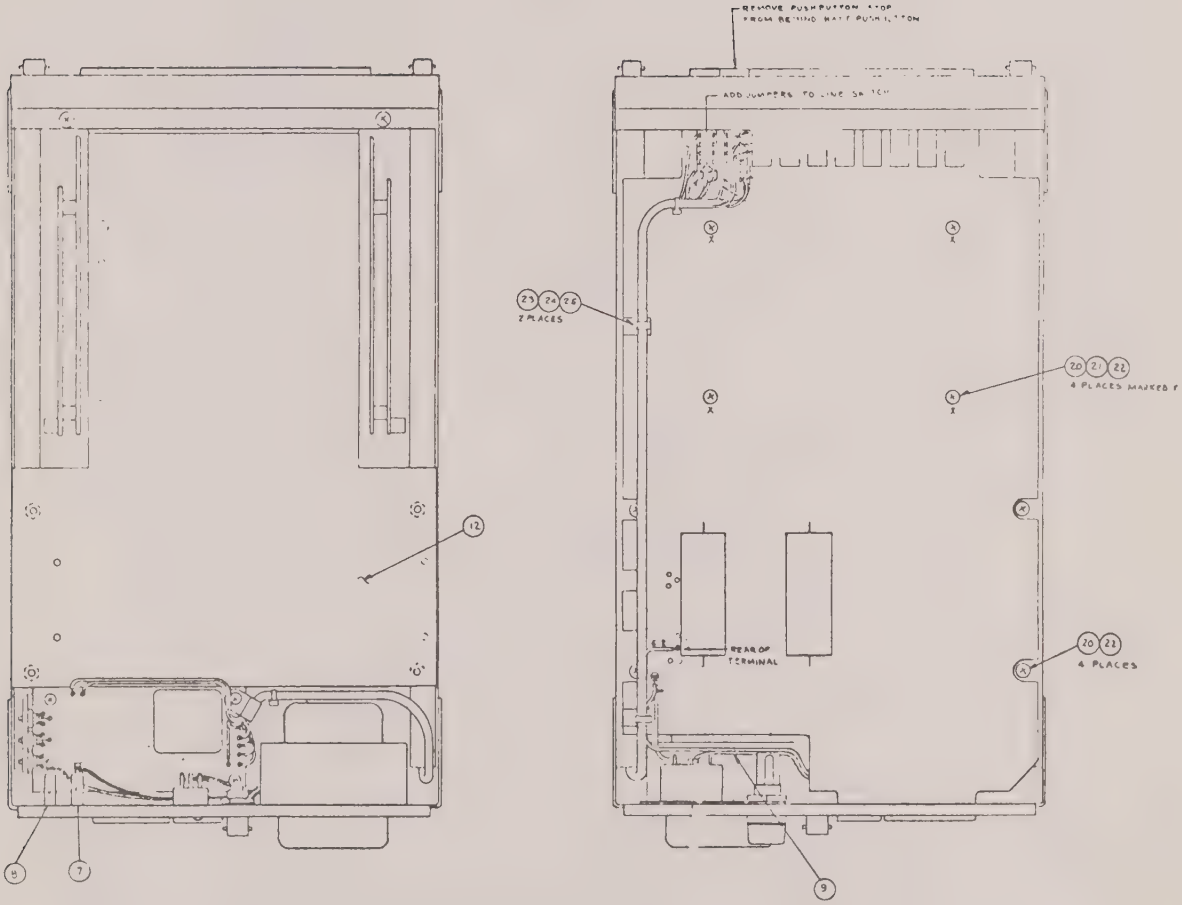
CIRCUIT DESCRIPTION, SCHEMATIC #7-04562301

Battery pack, BT1 and BT2, is provided only with Option 06. With the switch in LINE off position, battery charging is provided through Q4, Q5, R2, R1 and CR1. Charging voltage regulation is provided through VR1 and Q1.

There are two independent +5 V dc regulating circuits and a power inverter which supplies -16 V dc and +180 V dc to the counter. One of the +5 V dc regulators supplies voltage to the counter and the other provides regulated input to the power inverter. The +5 V dc regulator to the counter consists of Q6, Q2, U1, VR2, and the associated resistors. Operational amplifier U1 controls the input to the base of Q6 and the output of the Q6 collector is directly coupled to the base of Q2, the +5 V dc output transistor. Output of Q2 is adjusted with potentiometer, R14. The +5 V dc regulator Q3, Q7, U1, VR3, and associated circuitry operates in a like manner. The output is applied to power inverter U2.

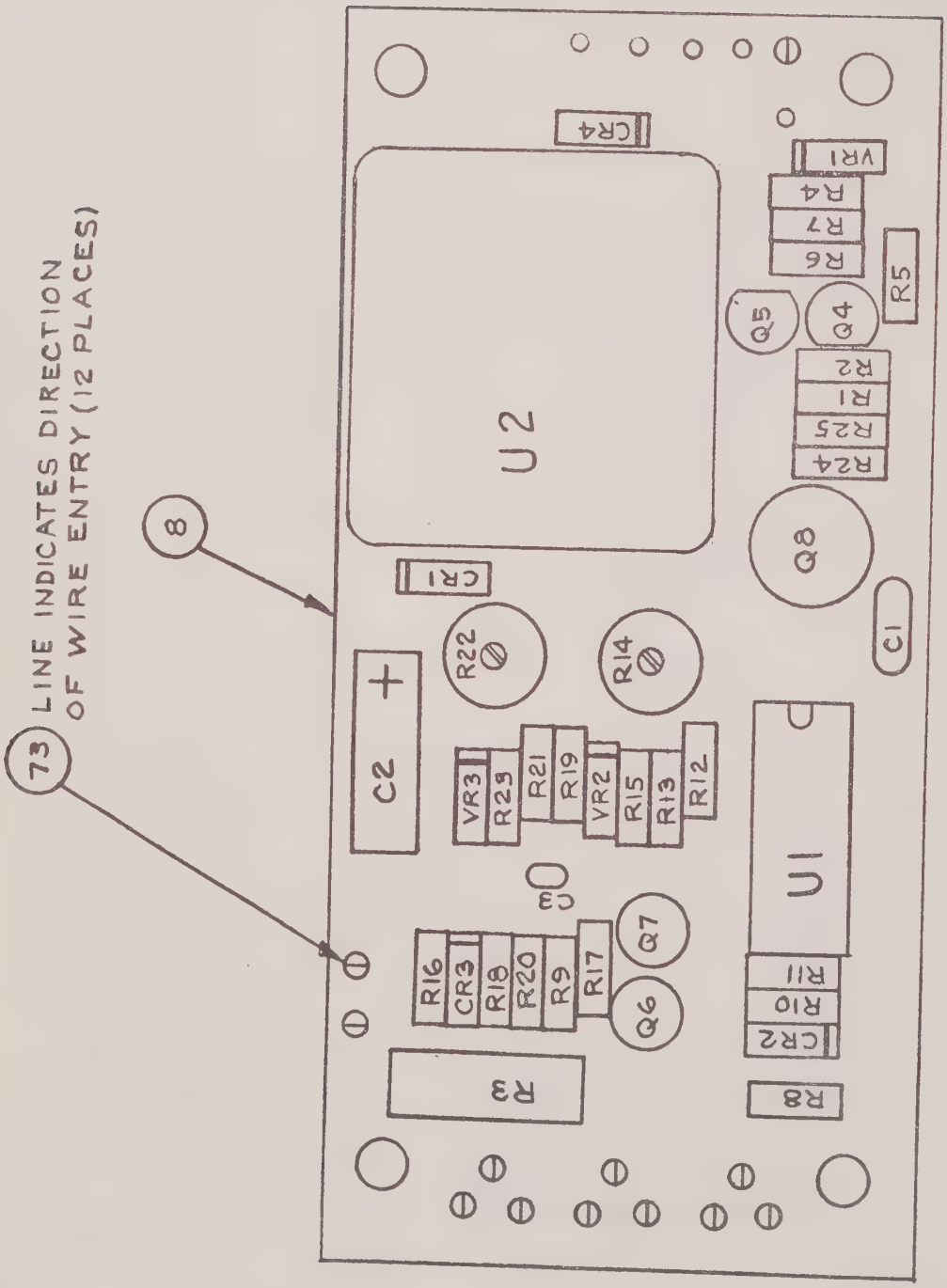


OPT 06, FINAL ASSEMBLY #045836 REV B

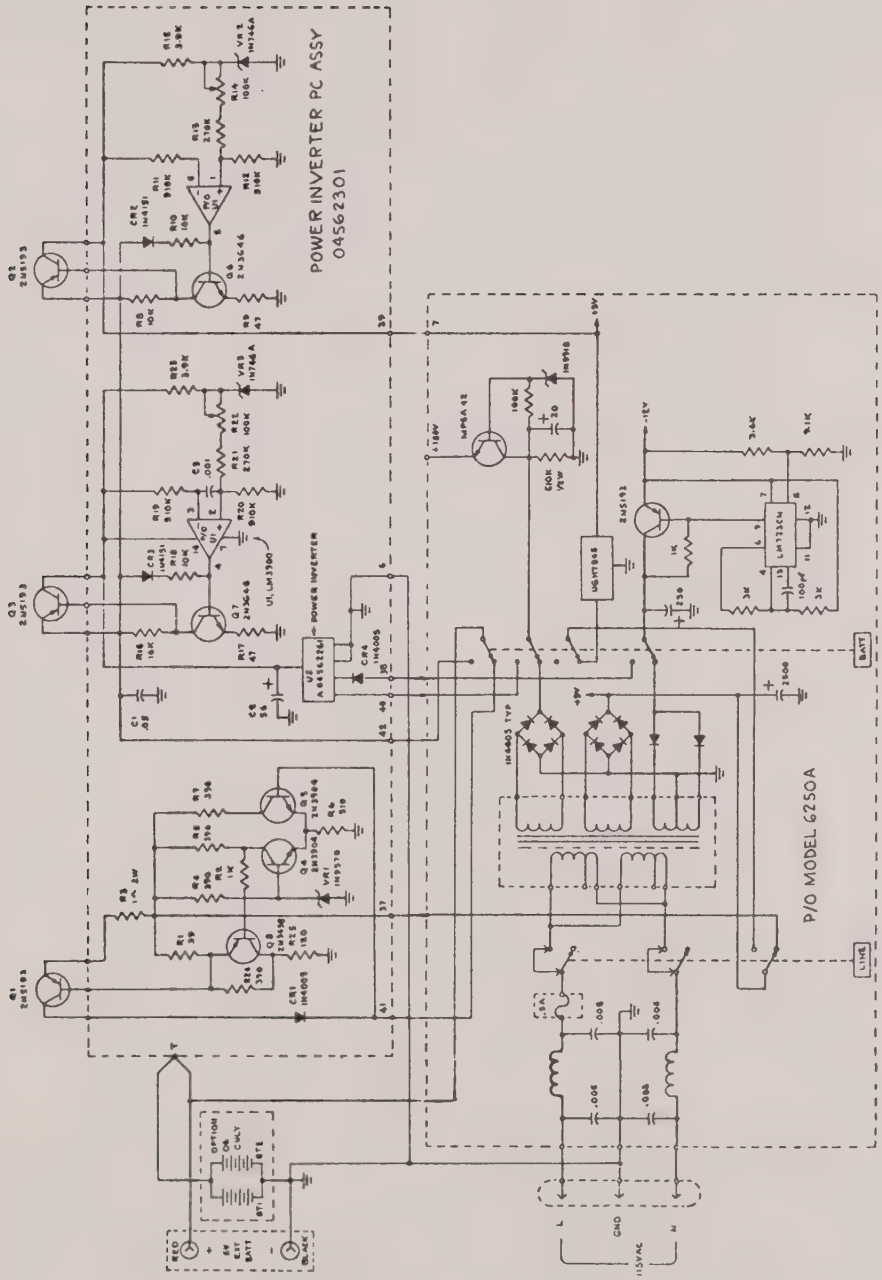


NOTE: THIS OPTION NOT AVAILABLE FOR UNITS WITH REAR PANEL INPUT OPTION 32 OR UNITS WITH HIGH STABILITY OSCILLATOR OPTIONS 11,12, OR 13.

OPT 07, FINAL ASSEMBLY #045834 REV C



OPT 06, OPT 07, POWER INVERTER ASSEMBLY #04562301 REV C



NOTES:
1) UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE 1/4 W 5% IN OHMS
ALL CAPACITORS ARE IN µF

OPT 06, OPT 07, POWER INVERTER SCHEMATIC #7-04562301 REV C

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: FINAL ASSEMBLY OPTION 06 and 07

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		OPTION 06 #045836				
		ASSEMBLY	52542	045836	045836	
		SCHEMATIC	52542	7-04562301	7-0452301	
		KIT, OPT. 06 Battery Pack	52542	04583691	04583691	1
		BATTERY, 6 V	25244	GC645-1	100042	2
		ASSEMBLY, Battery Clamp, Front	52542	04561401	04561401	1
		ASSEMBLY, Battery Clamp, Rear	52542	04561501	04561501	1
		CLAMP, Battery	52542	045614	045614	2
		OPTION 07 #045834				
		ASSEMBLY	52542	045834	045834	
		SCHEMATIC	52542	7-04562301	7-04562301	
		BANANAJACK, Black	74970	108-1103-001	101276	1
		BANANAJACK, Red	74970	108-1102-001	101275	1
		BANANAPLUG, Black	74970	108-1003-001	101279	1
		BANANAPLUG, Red	74970	108-1002-001	101278	1
		ASSEMBLY, Chassis	52542	045624	045624	1
		ASSEMBLY, Power Inverter	52542	04562301	04562301	1
		TRANSISTOR, Silicon, PNP	04713	2N5193	101405	3
		CHASSIS, 6VDC OPT 07	52542	045616	045616	1
		POWER INVERTER ASSEMBLY OPTION 06-07 #04562301				
		ASSEMBLY	52542	04562301	04562301	
		SCHEMATIC	52542	7-04562301	7-04562301	
	C1	CAPACITOR, Disc, .05 µF, 10 V	71590	UK10-503	100122	1
	C2	CAPACITOR, Tant, 56 µF, 6 V	56289	150D566X9006B2	100225	1
	C3	CAPACITOR, Mold, 1000 pF, 50 V	71590	CW15C102M	100251	1
	CR1	DIODE, Rectifier, 600 V	04713	1N4005	100413	2
	CR2	DIODE, Signal, 50 V	03508	1N4151	100385	2
	CR3	Same as CR2				
	CR4	Same as CR1				
	Q1	Part of Chassis Assembly				
	Q2	Part of Chassis Assembly				
	Q3	Part of Chassis Assembly				
	Q4	TRANSISTOR, Silicon, NPN	04713	2N3904	101377	2
	Q5	Same as Q4				
	Q6	TRANSISTOR, Silicon, NPN	07263	2N3646	101369	2
	Q7	Same as Q6				
	Q8	TRANSISTOR, Silicon, NPN	07263	2N3638	101360	1
	R1	RESISTOR, Comp, 39 Ω 5%, 1/4 W	01121	CB3905	101733	1
	R2	RESISTOR, Comp, 1 k 5%, 1/4 W	01121	CB1025	101569	1

EQUIPMENT/ASSEMBLY DESIGNATION: FINAL ASSEMBLY OPTION 06 and 07 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		POWER INVERTER ASSEMBLY OPTION 06-07 #04562301 (Cont'd)				
	R3	RESISTOR, Power, 1 Ω 5%, 2 W	75042	BWH	102214	1
	R4	RESISTOR, Comp, 390 Ω 5%, 1/4 W	01121	CB3915	101592	4
	R5	Same as R4				
	R6	RESISTOR, Comp, 510 Ω 5%, 1/4 W	01121	CB5115	101616	1
	R7	Same as R4				
	R8	RESISTOR, Comp, 10 k 5%, 1/4 W	01121	CB1035	101570	4
	R9	RESISTOR, Comp, 47 Ω 5%, 1/4 W	01121	CB4705	101560	2
	R10	Same as R8				
	R11	RESISTOR, Comp, 910 k 5%, 1/4 W	01121	CB9145	101885	4
	R12	Same as R11				
	R13	RESISTOR, Comp, 270 k 5%, 1/4 W	01121	CB2745	101769	2
	R14	RESISTOR, Potentiometer, Ceramic: 4-turn, 100 k 20%, 1/2 W, top adjust	80294	3339H-1-104	102298	2
	R15	RESISTOR, Comp, 3.9 k 5%, 1/4 W	01121	CB3925	101601	2
	R16	Same as R8				
	R17	Same as R9				
	R18	Same as R8				
	R19	Same as R11				
	R20	Same as R11				
	R21	Same as R13				
	R22	Same as R14				
	R23	Same as R15				
	R24	Same as R4				
	R25	RESISTOR, Comp, 120 Ω 5%, 1/4 W	01121	CB1215	101717	1
	U1	INTEGRATED CIRCUIT, Operational Amplifier	27014	LM3900N	045213	1
	U2	INVERTER, 5 VDC	52542	04562261	04562261	1
	VR1	DIODE, Zener, 6.8 V	04713	1N957B	100416	1
	VR2	DIODE, Zener, 3.3 V	03877	1N746A	100415	2
	VR3	Same as VR2				

CIRCUIT DESCRIPTION
OPTION 08
FINAL ASSEMBLY #045841

Option 08 provides an oscillator with improved temperature stability over the standard oscillator. Time base temperature stability is ±1 part in 10^6 from 0 to 50° C.

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: OPTION 08 FINAL ASSEMBLY #045841

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		ADD				
		OSCILLATOR, TCXO 10 MHz	01537	K1087A-1T1B	100033	1
		DELETE				
		ASSEMBLY, Oscillator P.C.	52542	04560801	04560801	1
		WASHER, #2 split-lock	MIL	MS35337-77	100661	2
		WASHER, #2 flat	MIL	MS51957-20	100614	2
		NUT, #2 Hex	MIL	MS35649-224	100636	2

CIRCUIT DESCRIPTION
OPTIONS 11, 12, 13, 3 MHz OSCILLATOR
FINAL ASSEMBLY #045849

DESCRIPTION

The oscillator options provide higher stability than the standard oscillator. The added assemblies include U1, 3 MHz oscillator, and the oscillator power supply.

SPECIFICATIONS OPTION 11

Temperature variation:	$<\pm 2$ parts in 10^{10}/C° typical. (Max ± 4 parts in 10^{9} over 20°C change within -10°C to +50°C)
Aging rate:	3×10^{-9} per day after 72 hour operation following a 72 hour shutdown.
After 24 hour shutdown:	1 hour to reach $\pm 6 \times 10^{-8}$ maximum; $\pm 1 \times 10^{-8}$ typical.
Short term stability:	2×10^{-10} rms, 1 second.
Voltage stability:	28 V ±1.0 V; 5×10^{-10} maximum.

SPECIFICATIONS OPTION 12

Temperature stability:	$<\pm 2$ parts in 10^{10}/C° typical. (Maximum ± 4 parts in 10^{9} over 20°C change within -15°C to +60°C).
Aging rate:	1×10^{-9} per day after 72 hours operation following a 72 hour shutdown.
After 24 hour shutdown:	1 hour to reach $\pm 6 \times 10^{-8}$ maximum; $\pm 1 \times 10^{-8}$ typical.
Short term stability:	1×10^{-10} rms, 1 second.
Voltage stability:	28 V ±2 V, $\pm 5 \times 10^{-10}$ maximum.

SPECIFICATIONS OPTION 13

Temperature stability:	$<\pm 5$ parts in 10^{11}/C° typical. (Maximum ± 1 part in 10^{9} over 20°C change within +10°C to +60°C).
Aging rate:	5×10^{-10} per day after 72 hours following 72 hour shutdown.

SPECIFICATIONS OPTION 13 (Cont'd)

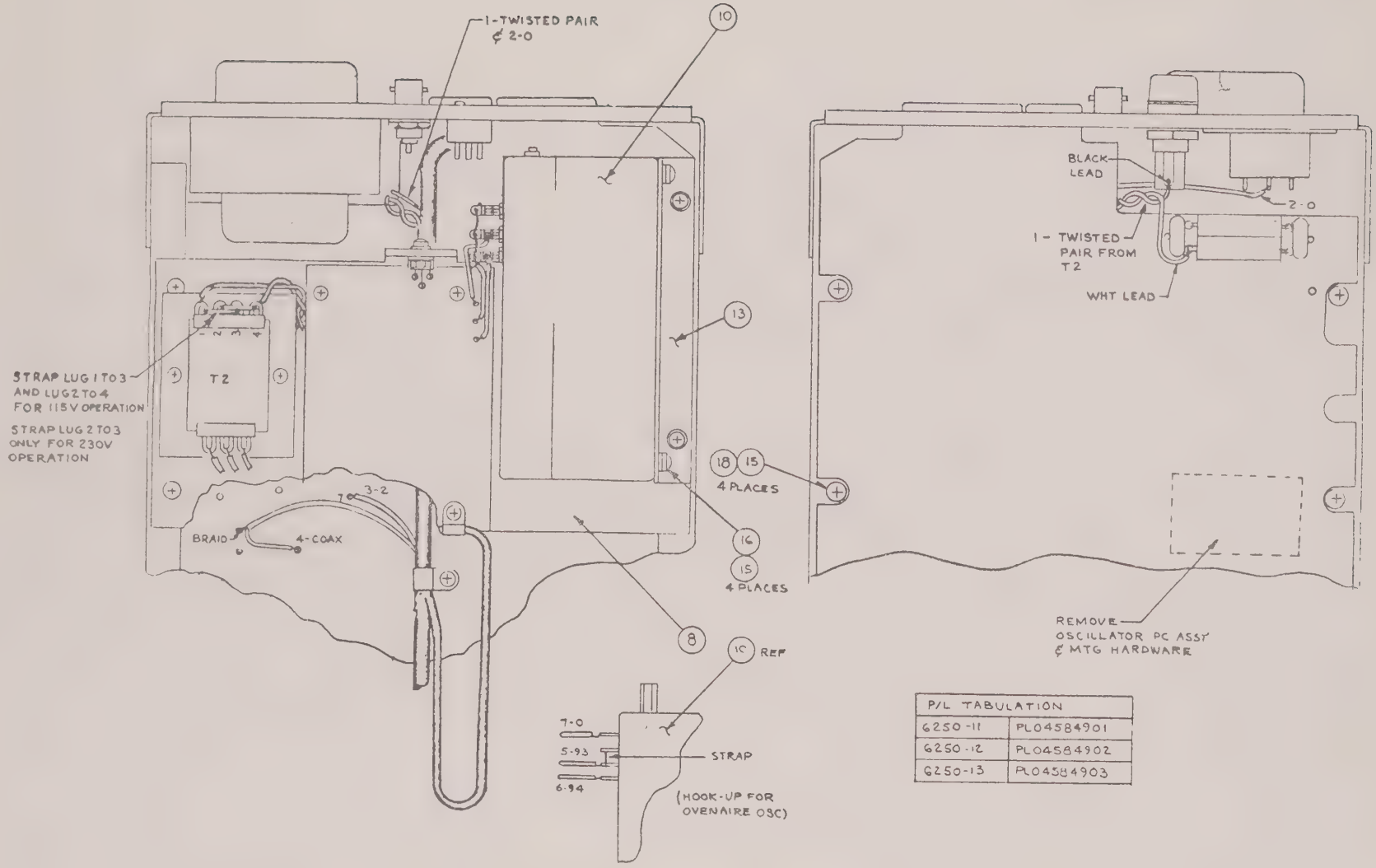
After 24 hour shutdown:	1 hour typical to reach 5 X 10^{-9} of turnoff frequency.
Short term stability:	5 X 10^{-11} rms, 1 second.
Voltage stability:	28 V ±2 V, ±5 X 10^{-10} maximum.

CIRCUIT DESCRIPTION, SCHEMATIC #045849

When the instrument power cord is plugged into line voltage, the bridge rectifier provides power to the crystal oven through the 24 V dc regulator, U1. The 3 MHz output is fed through amplifier Q1 to U2, dual AND/OR gate. The output of U2-6 is applied to U3-3 as a clock signal. U3 is a dual D flip-flop divide-by-three circuit. The 1 MHz output of U3 is applied through U4, exclusive OR gate, to provide a phase lock for the 10 MHz oscillator, U5. Decade counter, U6 provides a 1 MHz feedback to exclusive OR gate, U4, for phase comparison.

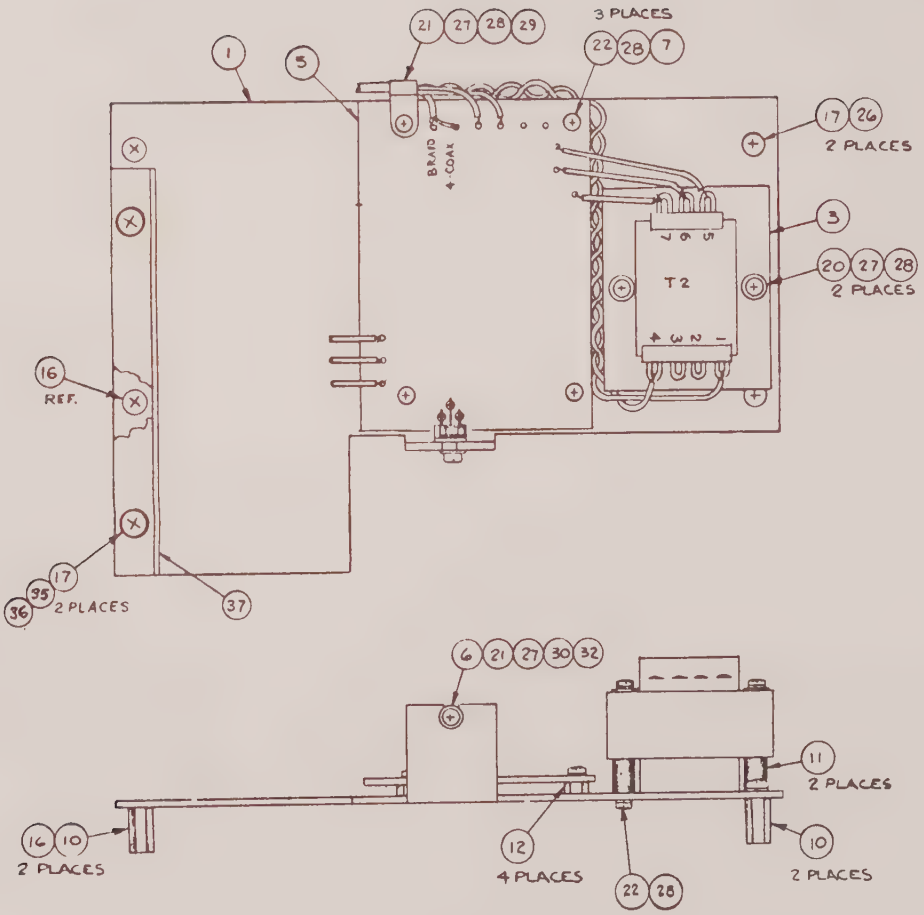
ADJUSTMENT:

Measure the voltage at TP1. Adjust C3 for 3.7 V dc at TP1.



P/L TABULATION	
6250-11	PL04584901
6250-12	PL04584902
6250-13	PL04584903

OPT 11, 12, 13, FINAL ASSEMBLY #045849 REV A

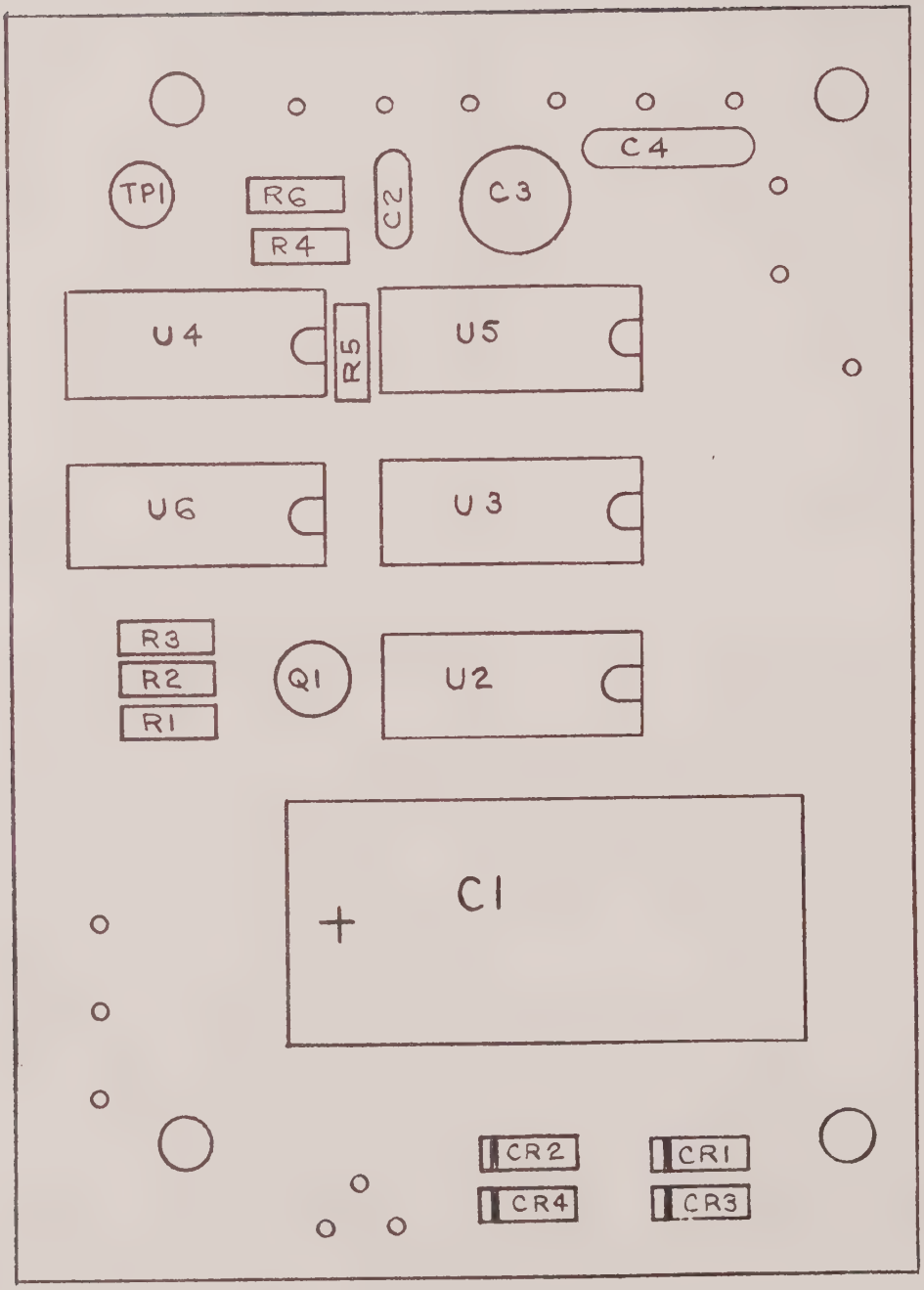


OPT 11, 12, 13, CHASSIS ASSEMBLY #045619 REV A

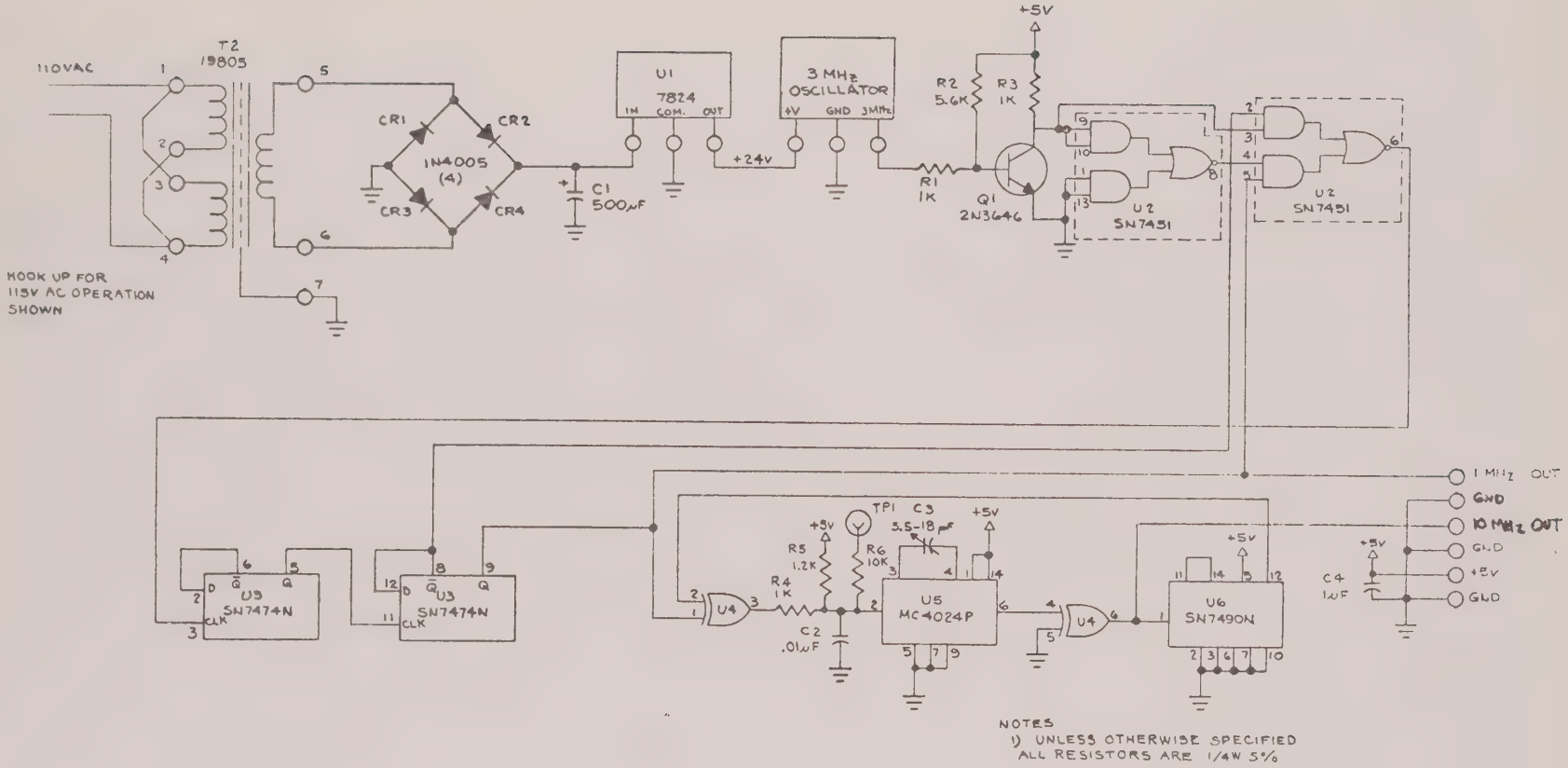
REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION FINAL ASSEMBLY #045849

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		CHASSIS ASSEMBLY #045619				
		CHASSIS, B Option	52542	045628	045628	1
	T2	ASSEMBLY, B Option	52542	04561801	04561801	1
		INTEGRATED CIRCUIT, Voltage Regulator	07263	UGH7824393	045246	1
		MOUNTING, B Oscillator Bracket	52542	039044	039044	1
		OPT 11,12,13 OSCILLATOR FINAL ASSEMBLY				
		OPT 11 #04584901				
		ASSEMBLY	52542	04584901	04584901	
		SCHEMATIC	52542	7-04561901	7-04561901	
		ASSEMBLY, Chassis	52542	045619	045619	1
		OSCILLATOR, High Stability (B3)	52542	033428	033428	1
		MOUNTING, B Oscillator Bracket	52542	039044	039044	Ref.
		OPT 12 #04584902				
		ASSEMBLY	52542	04584902	04584902	
		SCHEMATIC	52542	7-04561901	7-04561901	
		ASSEMBLY, Chassis	52542	045619	045619	1
		OSCILLATOR, High Stability (B)	52542	033427	033427	1
		MOUNTING, B Oscillator Bracket	52542	039044	039044	Ref.
		OPT 13 #04584903				
		ASSEMBLY	52542	04584903	04584903	
		SCHEMATIC	52542	7-04561901	7-04561901	
		ASSEMBLY, Chassis	52542	045619	045619	1
		OSCILLATOR, High Stability (B4)	52542	033429	033429	1
		MOUNTING, B Oscillator Bracket	52542	039044	039044	Ref.
		* *				
		DELETE				
		ASSEMBLY, 10 MHz Oscillator	52542	45608-4-1	45608-4-1	1
		COVER, Plate	52542	21398-1-1	21398-1-1	1



OPT 11, 12, 13, OSCILLATOR OPTION ASSEMBLY #04561801 REV B



NOTES
1) UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4W 5%

OPT 11, 12, 13, OSCILLATOR OPTION SCHEMATIC #7-045849 REV B

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION OSCILLATOR OPTION ASSEMBLY #04561801

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		ASSEMBLY	52542	04561801	04561801	
		SCHEMATIC	52542	7-045849	7-045849	
	C1	CAPACITOR, El Ax, 500 µF, 50 V	00853	053HJ501X0508	100296	1
	C2	CAPACITOR, Disc, .01 µF, 100 V	91418	TA110	100103	1
	C3	CAPACITOR, Varcer, 5.5-18 pF	72982	538-011A5.5-18	100136	1
	C4	CAPACITOR, Disc, 1 µF, 25 V	56289	5C023105X0250B3	100176	1
	CR1	DIODE, Rectifier, 600 V	04713	1N4005	100413	4
	CR2	Same as CR1				
	CR3	Same as CR1				
	CR4	Same as CR1				
	R1	RESISTOR, Comp, 1 k 5%, 1/4 W	01121	CB1025	101569	3
	R2	RESISTOR, Comp, 5.6 k 5%, 1/4 W	01121	CB5625	101584	1
	R3	Same as R1				
	R4	Same as R1				
	R5	RESISTOR, Comp, 1.2 k 5%, 1/4 W	01121	CB1225	101581	1
	R6	RESISTOR, Comp, 10 k 5%, 1/4 W	01121	CB1035	101570	1
	U1	Not Used				
	U2	INTEGRATED CIRCUIT, Dual 2-W AND-OR inverter, TTL	01295	SN7451N	025707	1
	U3	INTEGRATED CIRCUIT, Dual D flip-flop TTL	01295	SN7474N	025241	1
	U4	INTEGRATED CIRCUIT, Quad 2-input EXCL OR gates, TTL	04713	MC3021P	025789	1
	U5	INTEGRATED CIRCUIT, Dual VC Multivibrator TTL	04713	MC4024P	045206	1
	U6	INTEGRATED CIRCUIT, Decade Counter, TTL	01295	SN7490N	025732	1
	TP1	TEST POINT, Brown, right angle	74970	105-0858-001	100546	1
	Q1	TRANSISTOR, Silicon, NPN	07263	2N3646	101369	1

CIRCUIT DESCRIPTION
OPTION 32
FINAL ASSEMBLY #053006

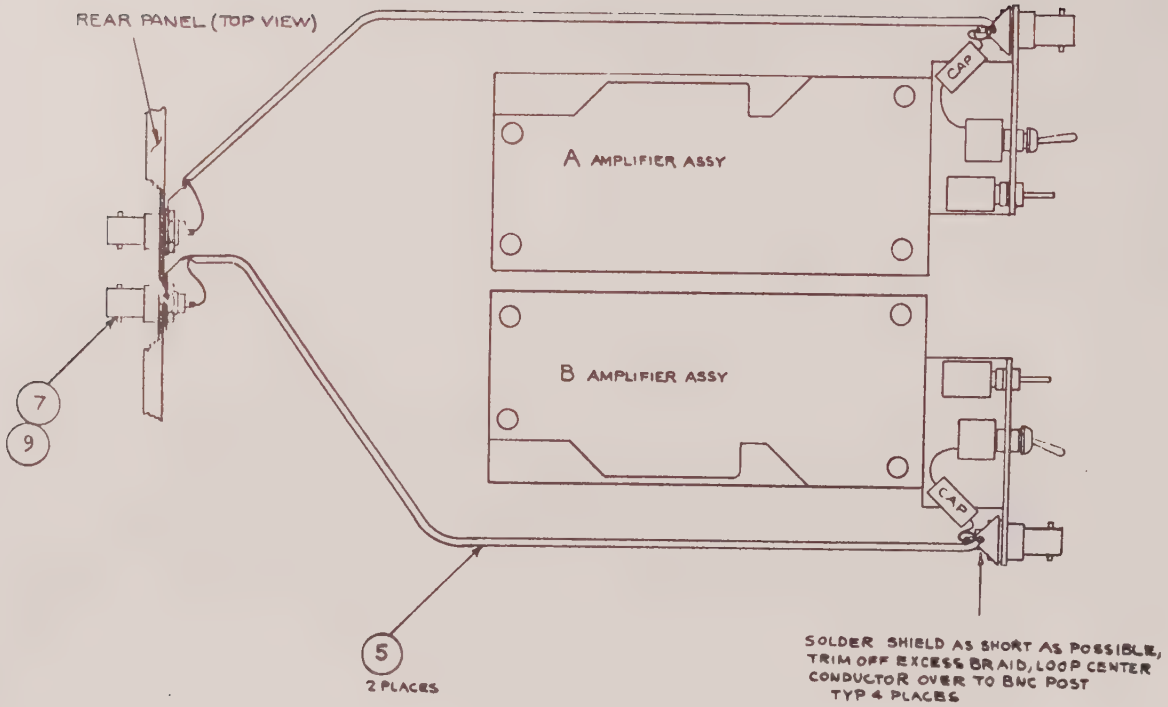
DESCRIPTION

Option 32 provides a means to put A INPUT and B INPUT signals into the Model 6250A from the rear panel.

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: OPTION 32 FINAL ASSEMBLY #053006

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		RECEPTICLE, BNC RF	MIL	UG-1094/U	101155	2
		SOLDER, Lug .375 Mounting	83330	1497	100495	2



NOTE: THIS OPTION NOT AVAILABLE FOR UNITS WITH DC OPERATION OPTIONS (OPTIONS 06 & 07)

OPT 32, FINAL ASSEMBLY #053649 REV A

CIRCUIT DESCRIPTION
OPTION 35
FINAL ASSEMBLY #045787-4-1

DESCRIPTION

Option 35, BCD Conversion Cable, converts the group-serial parallel BCD outputs into a standard 8-4-2-1 parallel format, including decimal placement and legend units. P1 is a 50 pin Amphenol connector, 57-40500. Table OPT 35.1 lists the functions and pin connections for the BCD output.

CIRCUIT DESCRIPTION, BCD CONVERSION ASSEMBLY, SCHEMATIC #7-045603-7-1

The interlaced multiplex signal from the Mother Board is applied, through AND gates, U1, to quad D flip-flop, U4 through U11, when the blanking gate is positive. If the blanking line is negative (low), the unit will transfer zeros into the registers. The strobe oscillator signal is applied through Q1 to one input of NOR gates U2 and U3. Decoded strobe pulses are applied to the other input. When both pulses are low, the strobe gates are high and the information is transferred from the group serial line to the respective quad D flip-flop, which is used as a storage register. Coded decimal point information is applied to U12 and U13 and stored. A +5 V dc reference voltage and group reference are also supplied to the registers and the remote plug. External Gate, Reset, Gate Out, and Off Scale are also applied to the assembly and terminated on the board. These are available for remote programming should this be desired.

TABLE OPT 35.1 REAR PANEL BCD CONNECTIONS

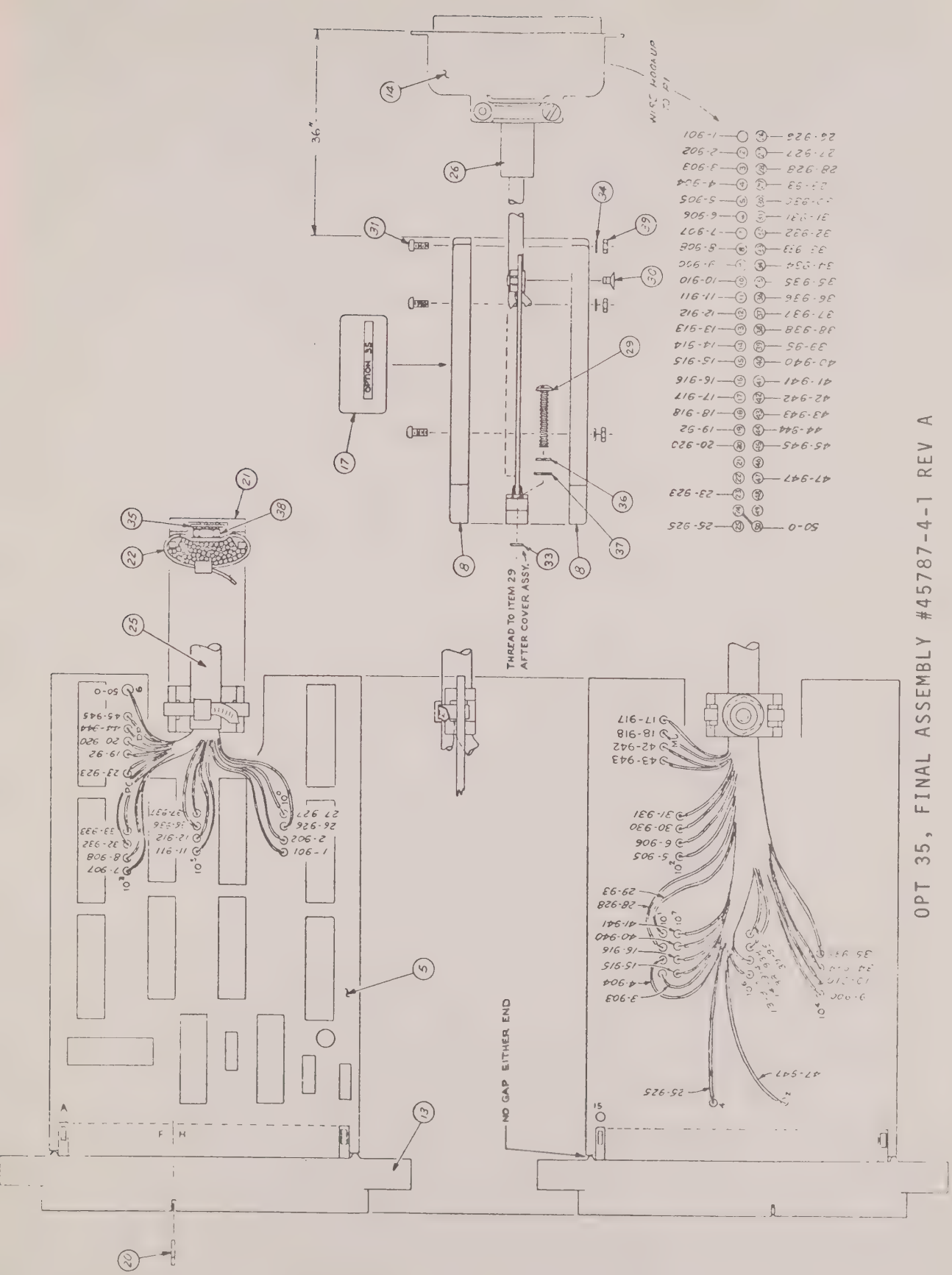
FUNCTION	BCD	PIN	FUNCTION	BCD	PIN
10^0	1	1	10^2	1	5
	2	2		2	6
	4	26		4	30
	8	27		8	31
10^1	1	3	10^3	1	7
	2	4		2	8
	4	28		4	32
	8	29		8	33

TABLE OPT 35.1 REAR PANEL BCD CONNECTIONS (Cont'd)

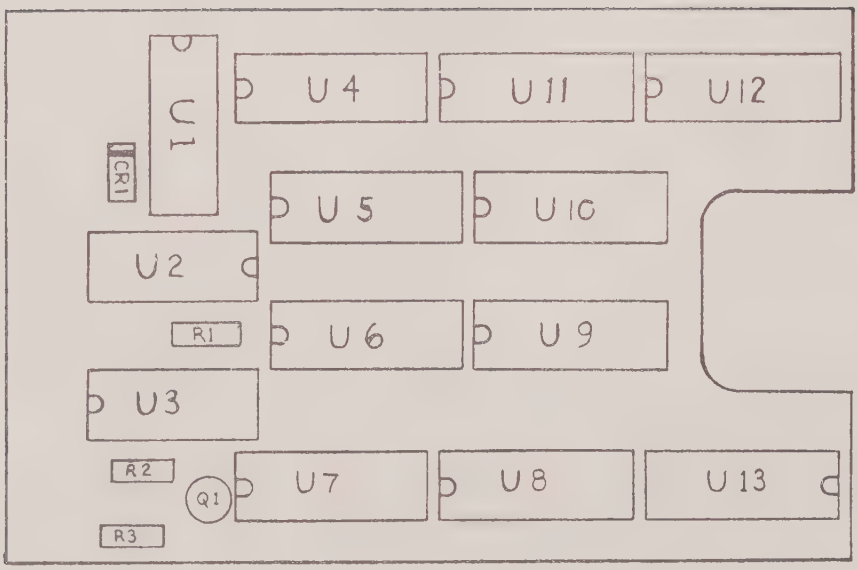
FUNCTION	BCD	PIN
10^4	1	9
	2	10
	4	34
	8	35
10^5	1	11
	2	12
	4	36
	8	37
MU	1	17
	2	18
	4	42
	8	43

FUNCTION	BCD	PIN
10^6	1	13
	2	14
	4	38
	8	39
10^7	1	15
	2	16
	4	40
	8	41
DP	1	19
	2	20
	4	44
	8	45

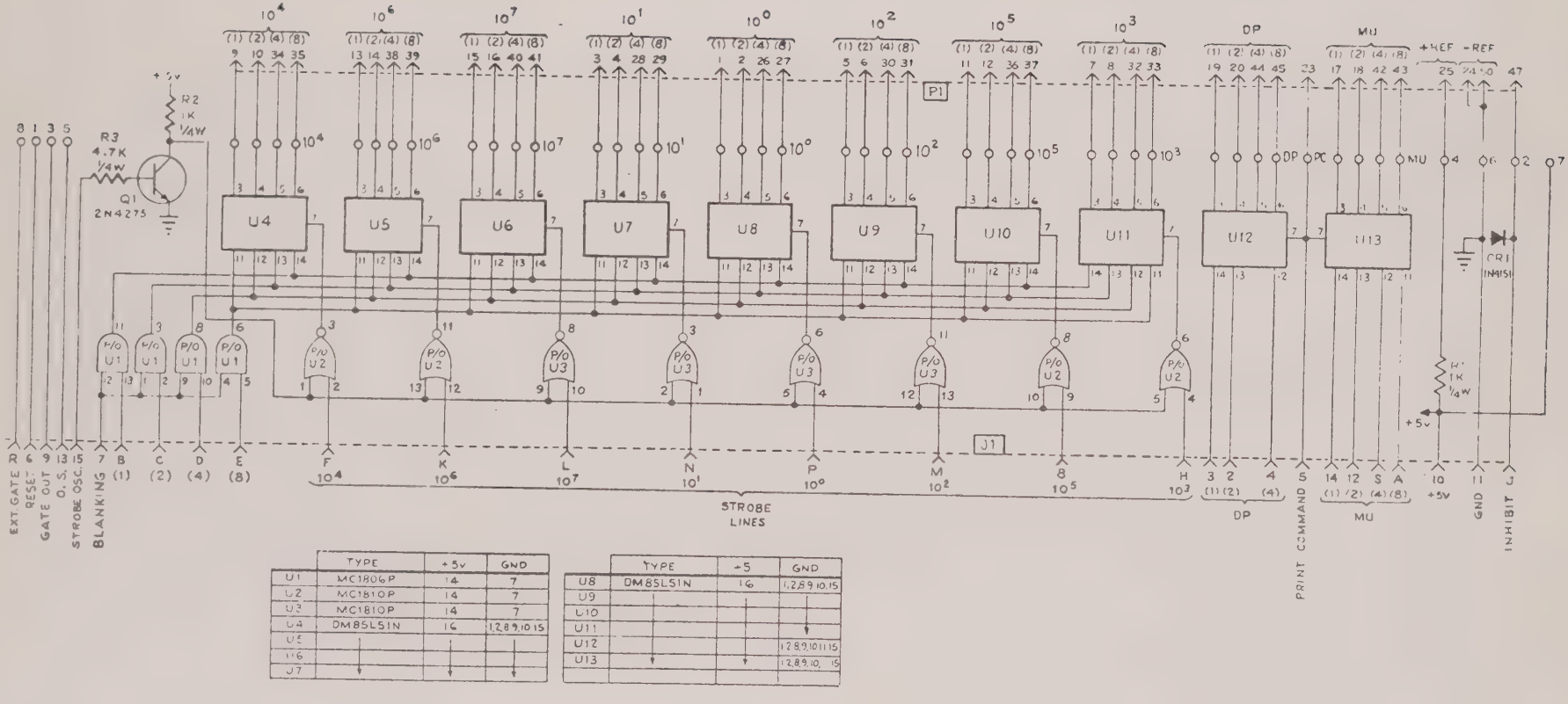
+ Reference (+5 V)	25
- Reference (GND)	24,50
Inhibit	47
Print Command	23



OPT 35, FINAL ASSEMBLY #45787-4-1 REV A



OPT 35, BCD ASSEMBLY #45603-4-1 REV B

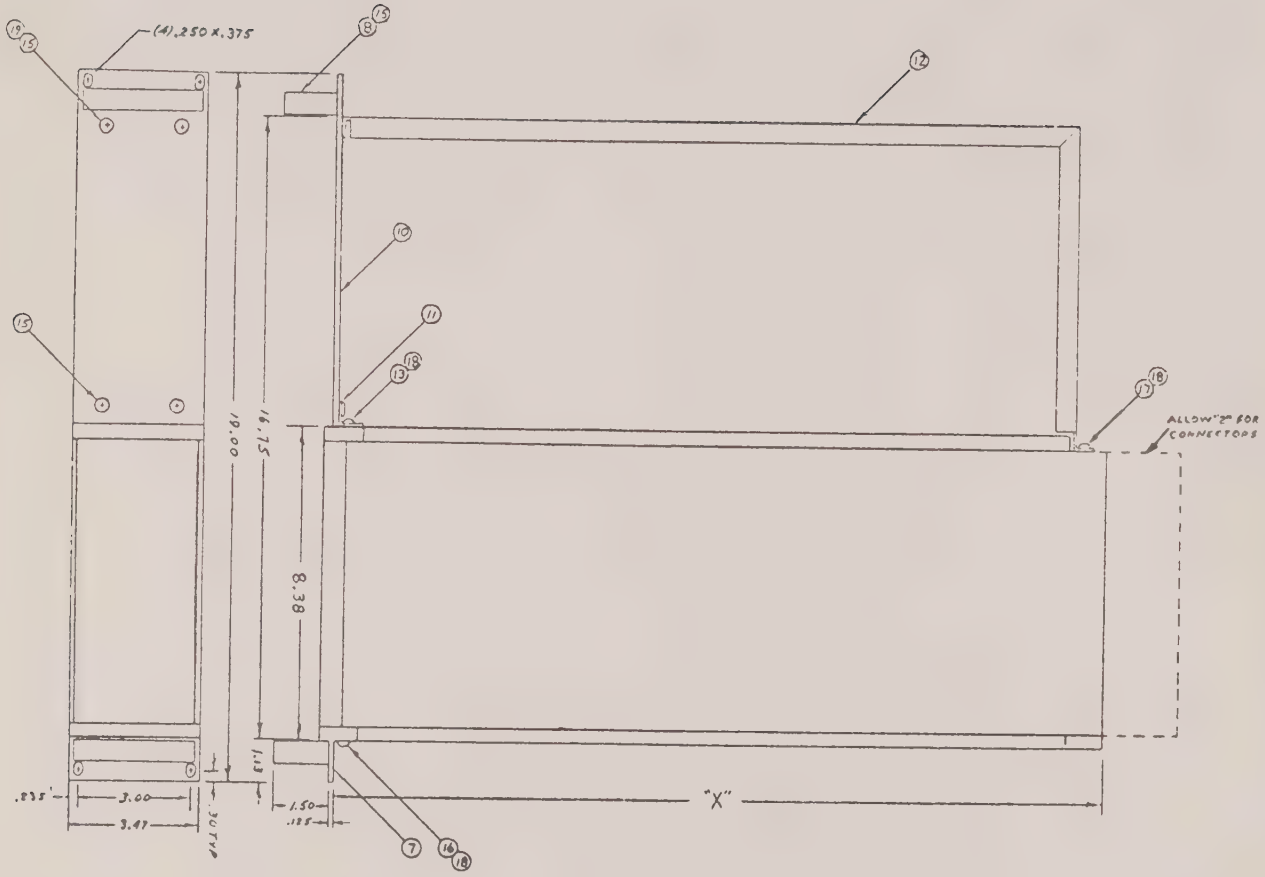


	TYPE	+5v	GND
U1	MC1806P	14	7
U2	MC1810P	14	7
U3	MC1810P	14	7
U4	DM85LS1N	16	12,8,9,10,15
U5			
U6			
U7			

	TYPE	+5	GND
U8	DM85LS1N	16	1,2,8,9,10,15
U9			
U10			
U11			
U12			12,8,9,10,11,15
U13			12,8,9,10, 15

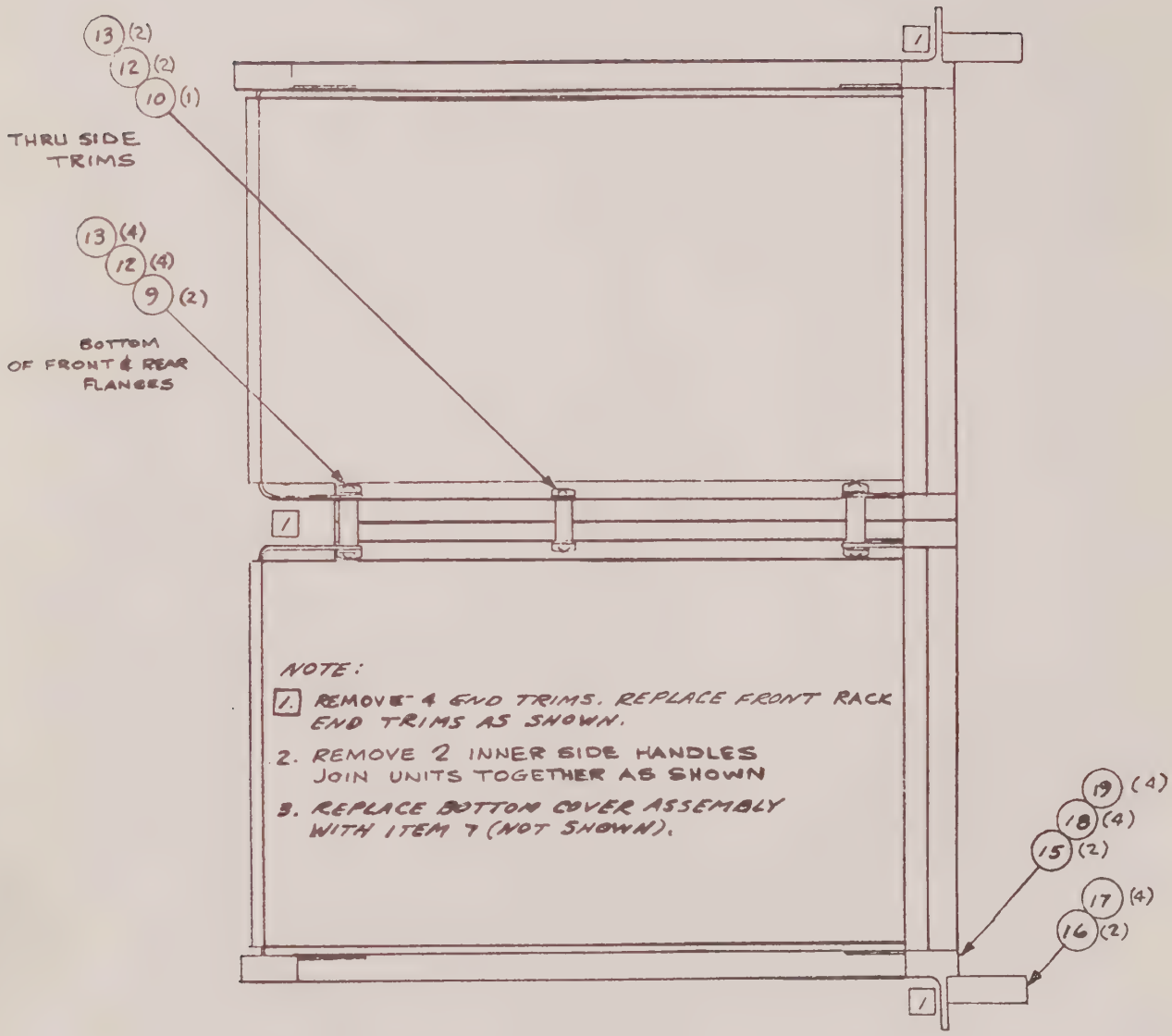
OPT 35, BCD SCHEMATIC #45603-7-1 REV B

(1)	(2)	(3)	(4)	(5)	(6)



TABULATION		
P/L #	"X"	INSTA. DEPTH
45410-1	8.75	9.12
45410-2	10.75	11.12
45410-3	12.75	13.12
45410-4	14.75	15.12
45410-5	16.75	17.12
45410-6	18.75	19.12
45410-7	20.75	21.12

3 1/2" HALF RACK ASSEMBLY #045410-3 REV A



DUAL RACK MOUNT ASSEMBLY #037492-3 REV A

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION RACK MOUNT ASSEMBLY

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		3 1/2" HALF RACK ASSEMBLY #4541003				
		ADD				
		TRIM, End Rack Mount	52542	045476-2	045476-2	1
		HANDLE	06540	11351-A-0832-2	100927	2
		PANEL, Rack Mount	52542	039953-2	039953-2	1
		PANEL, Rack Mount Adapter	52542	039954-2	039954-2	1
		ADAPTER, Chassis	52542	045411-3	045411-3	1
		* *				
		DELETE				
		TRIM, End	52542	033693	033693	2
		HANDLE	52542	033570-3	033570-3	2
		ASSEMBLY, Bail & Foot	21604	MP40008-1	100971	1
		DUAL RACK MOUNT ASSEMBLY #37492-3				
		ADD				
		COVER, Bottom	52542	053050-3	053050-3	1
		TRIM, End Rack Mount	52542	045476-2	045476-2	2
		HANDLE	06540	11351-A-0832-2	100927	2
		* *				
		DELETE				
		COVER, Bottom	52542	045065-3	045065-3	2
		TRIM, End	52542	039033	039033	4
		HANDLE	52542	033570-3	033570-3	4

CHAPTER 9
SUPPLEMENTAL INFORMATION

9.1 INTRODUCTION

This Chapter contains revised or updated information reflecting changes in production requirements of this instrument. This information can include changes in assembly/schematic drawings, parts lists, operating instructions, calibration procedures, etc. Changes to parts lists will contain only the added parts, plus a list of deleted items. The supplemental pages for each assembly will be identified with the words SUPPLEMENTAL INFORMATION, followed by the identification of the changed assembly. For example, if the Mother Board Assembly is to be changed, the package identification will read as follows:

MODEL 6250A
SUPPLEMENTAL INFORMATION
MOTHER BOARD ASSEMBLY
SCHEMATIC #7-05355501

Page identification for an October 19XX change will be:

6250A-10-XX SUPPLEMENT; page numbering will be in numerical order.

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